# SOCIO-HISTORICAL PERSPECTIVES ON THE LABORATORIES AND APPARATUS OF THE NEW PSYCHOLOGY

---

A thesis
submitted in partial fulfilment
of the requirements for the Degree
of
Master of Arts in Psychology
in the
University of Canterbury
by
David Youngmeyer

---

University of Canterbury
1992

"... a science without memory is at the mercy of the forces of the day" (Samelson, 1974, 229).

# Contents

# Acknowledgements

Many people have played some part in this thesis.

My supervisor Dr Brian Haig was accepting of my unusual topic, gave me space to develop my own ideas and always took a positive attitude to the topic and my work.

My friend and colleague, and same time thesis writer Ms Rachel Lawson, was a constant source of contact with reality while I wrote this. In the final stages we would often sit within sight of each other as a means of mutual encouragement. It seemed to work.

My old flatmate and friend Mr Barry Anderson put his considerable knowledge, talent and sensitivity with early cameras and other instruments from the past, to use in the reclamation of the Psychology apparatus in Chapter 5.

Messrs Jim Pollard and John Barton helped to locate and identify this apparatus as well as taking care of the mechanics of obtaining a display case.

Mr Phillips shot and developed all of the photographs of apparatus included here.

My friend, Ms Mon-Hua Chen, who despite being very far away, or perhaps because of that, was one hundred percent responsible for the motivation required to complete this thesis. Danke Mon-Hua.

# List of Figures

# Abstract

A variety of socio-historical perspectives are offered on the laboratories and apparatus of the New Psychology. The laboratories and apparatus, although defining characteristics of the New Psychology, have been largely ignored by Historians of Psychology. Chapter one considers the laboratory in America. Inconsistencies in secondary source accounts of laboratory establishment dates are traced back to variations amongst early accounts themselves. The physical and organisational nature of the laboratory in its ideal and actual forms, and three stages of laboratory development are identified. Chapter two points to the importance of apparatus in enhancing our understanding of the New Psychology and outlines recent historical work concerning apparatus. The development of apparatus is considered in terms of general development and associated processes. It is suggested that attention to the place of both psychologists and mechanicians in this development will provide further insights into apparatus development. Chapter three provides an historical account of the early development of the laboratory at Canterbury College and a reevaluation of the role of Charles Salmond, the Professor of Philosophy at the College, in this development. The chapter demonstrates the value of utilising primary sources for writing the History of Psychology. Chapter four details a project to collect, identify and preserve various apparatus of the New Psychology once used at Canterbury College. The apparatus is documented in both written and pictorial form.

# Chapter One

## Introduction

The History of Psychology as a topic for a Masters thesis in New Zealand, is somewhat unusual. To my knowledge, such a topic has not been attempted by a graduate student in this country before. When I first began considering such an endeavour, there were compelling reasons for not going any further than the stage of contemplation. It was suggested, presumably because so little has been written about New Zealand's Psychological history, that I should not write about New Zealand in my research. This advice was perhaps also motivated by the prevailing view that there is not very much of substance in Psychology's history in New Zealand and therefore, a treatment of it would most likely be superficial not to mention brief. I believe such a view is reflective of the general trend amongst New Zealand psychologists of adopting the methods and theories of foreign psychologists, most typically British and North American. As a result, we tend to consider our own history to be merely a mirror image of these countries' histories. In essence, we have not only adopted a Psychology from overseas, but also an associated history. This has led to the devaluing of our own history and the reluctance to look inwards historically.

Given what amounted to an injunction against writing about the history of New Zealand Psychology, I considered instead, the more acceptable task of considering the history of American Psychology. A problem quickly became

evident however. How could one do history without access to primary sources? This problem could be overcome by using secondary sources. It is clear that the History of Psychology is, even in the USA, a nascent discipline. The important work being done in the name of the new critical history (e.g. Danziger, 1990) appears promising for enhanced development, although at this stage it offers mostly an attitude towards historical research. This new attitude offers a new way of doing the History of Psychology, one aspect of which, is the affirmation of the importance of historical sources, in all their forms. The critical historian of Psychology should, I believe, always be willing to consult the original sources. By so doing, he or she avoids reliance on the soft data of secondary sources. Instead, he or she interprets and analyses the raw sources. Contributions to the History of Psychology, that are not purely historiographical, and which avoid the original sources, result in a loss of depth, second-hand analyses and interpretations and possibly the selective or unfair representation of history. Additionally, a separation from the historical period of concern is heightened.

For such reasons, I considered it necessary to use original sources as much as possible, settling upon the use of published articles written by the new psychologists themselves. Reading these accounts resulted, apart from delight in their rhetoric and mode of writing, in many insights and a close-up view of aspects of the New Psychology otherwise unobtainable. Chapters two and three provide, respectively, an account of the laboratories of the new psychologists and some perspectives on their apparatus and its development.

Chapters, four and five, relate more or less to the New Psychology in New Zealand. It is a curious fact of the New Psychology in New Zealand, that it arrived about 25-30 years later than in the USA. Despite this tardiness, it must

nevertheless still be considered as a version of the New Psychology. I have included material on New Zealand, against initial advice, for a number of reasons, possibly the major one being that there is actually quite a lot of material available for use, if only one can find it. A second reason, is that the History of Psychology in New Zealand is so sparsely researched that far from being a deterrent, it presents all the opportunity of a newly discovered and unexplored country.

It is true, nevertheless, that while there is opportunity, there is also a lot of associated hard labour. The sources, where they exist, are scattered in all manner of obscure locations around the country. At present, finding source material is the largest impediment to historical research. What is required to remedy this situation, is a concerted, directed and sustained effort on the part of New Zealands' historians of Psychology to establish some form of archive or library collection along the lines of, for example, the Archives of the History of American Psychology in the USA and the Institut fur Geschichte der Neueren Psychologie in Germany . Just by its very existence, such an organisation would attract historical material and interest, but with the work of a staff it would actively advance the History of Psychology by centrally storing documents and other materials, searching out new materials and generally offering a stimulus for research.

Chapter four offers a primary source based account of the early laboratory at Canterbury College. This research, taking many months, would have been immeasurably quickened by the availability of some sort of archival support relating to the History of Psychology. Such support would also mean that other similar research would be more likely to be attempted in the future. The chapter demonstrates the usefulness of primary sources in providing a closer approximation to the truth than is offered by ignoring them. Additionally, by

comparing secondary accounts with primary sources, it provides an historiographical example of the way in which the slavish reliance on a restricted number and variety of historical sources combined with a presentist attitude (Stocking, 1965), which involves an uncritcal or biased use of history, can result in a rather inadequate history.

The fifth and final chapter, involved the preservation and documentation of Psychology apparatus from the Canterbury College laboratory. This sort of work is, I believe, an important part of advancing the History of Psychology in New Zealand, and would form one aspect of the duties of any archive devoted to Psychology.

# Chapter Two

## The Psychology Laboratory in America

The last quarter of the nineteenth century and the period up to the first world war in America witnessed the birth of the Psychology laboratory and its phenomenal growth and development in universities, colleges and other institutions. From the first laboratory, established by William James between 1874-6, over 60 laboratories had been established by the start of world war one.

The aim of this chapter is to provide some description of the development of laboratories in America, as well as, the typical laboratory and typical apparatus. Additionally, three stages in the development of laboratories will be identified.

Attempts at description of the development of laboratories have already been made. Some were made by participants in the period themselves, most notably by Krohn (1890-1), Delabarre (1894) , Ruckmick (1912, 1926) and Garvey (1929). Krohn provided "a description of the laboratories and the apparatus in use, a note on the development of the departments, and, in some cases, an evaluation of the equipment, including books, instruments, and scholarship and fellowship funds" (quoted in Ruckmick, 1912, 517). Delabarre noted that laboratories differed in terms of emphasis on teaching and demonstration, research or a combination of both. He suggested that between eight and nine laboratories were only for teaching and demonstration purposes; 5-8 for research only; and the remaining 10 combined both functions (Ruckmick, 1912). Also,

there are authors (e.g. Miner, 1904) who made general surveys of Psychology which included various aspects such as laboratories.

It was apparent to the two earliest surveyors, Krohn and also Delabarre, that there was something special about the growth of laboratories in Psychology. This is especially interesting because they were participants and can not have been expected to have a clear and relatively objective view of events. It is unknown what criteria they used to choose the laboratories they included, of which Krohn considered 11 colleges and universities, and Delabarre, three years later, surveyed 27. They were not necessarily exhaustive of all laboratories, perhaps selecting only institutions with the larger and better known laboratories of those available.

There are also many papers of the period, which make some general comments about laboratories, as well as papers describing individual laboratories. These latter are rich in information about laboratories of the period and from these can be drawn first, the idealised form of the laboratory, and second, the typical features of the laboratories (Stratton, 1896; Fernberger, 1928; Krohn, 1892b; Baldwin, 1892; Martin, 1906; Conklin, 1926; Reymert, 1928; Langfeld, 1926; Weiss, 1927; Anon, 1892a; Cattell, 1888).

More recent contributions have included, most notably, Harper (1950), Albrecht (1960) and Popplestone & McPherson (1984). Critical consideration will be given to these studies, a characteristic which has been, on the whole, conspicuously absent from these papers themselves.

The modern treatments have been concerned largely with dates of establishment, and have given either a shallow or preconceived coverage. The best treatment is

by Popplestone & McPherson (1984), because they pose the most interesting questions for future research and make the most astute observations.

It is important to make a detailed analysis of the two studies by Ruckmick (1912) and Garvey (1929). They are the only two primary sources available which provide survey information about laboratory establishments. Another reason to consider these papers, is that previous authors of the secondary source literature, that is to say modern writers or historians of Psychology, have noted that discrepancies exist between authors, but the reasons for the existence of these discrepancies have not been discussed. Albrecht (1960) relegates discussion of discrepancies to a footnote, where he points out that "there is some disagreement among the sources, with all of them listing small laboratories not noticed by the others" (135). Harper (1950) makes no mention of any discrepancy, although he refers to all of the primary papers. This is not without irony, given that his paper was concerned with judging precisely when the first Psychology laboratory was established. Popplestone & McPherson (1984) note also that some discrepancy with information exists. They attempt to explain this by pointing out that there are two sources for laboratory development information - one is primary source information, that is, articles written by participants of the period; the other is secondary information.

It is fair to suggest that when one has a number of different sources, each giving varying accounts of a subject, confusion is generally the net result. But this is not a sufficient explanation for discrepancies among earlier accounts. Also, it ignores the real reason for the confusion among secondary writers, which stems from their inadequate, superficial and uneven consideration of the available primary sources. Additionally, it ignores the fact that a different sort of confusion was existent among primary writers. It is to these accounts we need

to direct our attention so as to discover why participants themselves did not have a clearer picture. I believe the discrepancies among primary accounts arise from the way in which they collected the information on which their articles and summaries of laboratory development were based. Therefore, it is necessary to scrutinise these accounts closely.

The earliest survey I have located is Ruckmick (1912). Referring to Delabarre's survey, he noted that the progress of Psychology "has continued almost steadily until the present time, when any large university in the country would consider its plant insufficient in equipment without a psychological laboratory of some sort" (518). Ruckmick aimed, then, to "reckon up, as it were, the assets and liabilities in the account to date of our still youthful discipline" (518). However, his survey was not comprehensive and focussed only on "the larger colleges and universities in the country" (518). Additionally, the final survey was comprised from two earlier and independent surveys, not solely restricted to Psychology laboratories. These were made variously by Titchener and Ruckmick, although it was Ruckmick who "enlarged and elaborated by means of a statistical inquiry" (519) these earlier efforts.

The respondents to the questionnaire were, originally selected by Titchener. Although the total number of questionnaires sent out is unknown, 39 responses were returned completed. We do not know, therefore, whether the survey was originally intended to be comprehensive, or what response percentage was achieved.

Effectively, for our purposes, Ruckmick provides a list of laboratories and their establishment dates. Based on this information, he also offers a commentary on the historical development of laboratories. However, this commentary is flawed for two reasons. It is based on incomplete data, and it purports to give an

accurate and complete account of laboratory development in the period considered.

Other writers have uncritically accepted his account as correct, so it is important to point out the flaws, in order to be better able to evaluate the information available relating to laboratory establishment dates.

His account is as follows,

> Laboratories first began to appear in definite form late in the 'eighties'. Up to and including 1890, eight such laboratories had been started, and 5 of these were at western state institutions. For three years thereafter three laboratories were founded per year. Then the pace kept on by ones and twos, with threes in 1900 and 1901, until a halt was called in 1904. A few more have come since then. The two most prolific periods seem to be about 1890 and 1893 (Ruckmick, 1912, 521).

The next study to provide information about laboratory establishments was Garvey (1929). This was the first comprehensive survey of Psychology laboratories in America. The rationale for the study was that the last survey was made in 1912 and "since no comprehensive list of laboratories with dates of foundation, etc, is available" (652). By this statement we see that Garvey recognised the deficiency in the earlier studies.

A questionnaire was sent to "every educational institution of higher learning in America which is credited with 1,000 students or more in the 1926 College Blue Book, and to smaller schools which were suspected of having a Psychology laboratory" (652). Of 200 questionnaires posted, 141 or about 65% were completed and returned. Apart from this large number of questionnaires and the relatively high response rate, further confidence is given to the comprehensive nature of the information collected by the fact that 24 replying institutions had no

Psychology laboratory. So the questionnaire canvassed not only known laboratories, but also those institutions which were suspected of having had a laboratory.

A comparison of the laboratory establishment information from Ruckmick and Garvey demonstrates the difference in comprehensiveness between the two set of data and allows for a more accurate picture to emerge, or at least a picture which is more realistically inclusive of doubts and confusions. The comparison consists of two bar graphs of laboratory establishment dates, illustrating the most active periods and the time-scale of establishments (figures one and two). The comparison clearly demonstrates the deficiencies, of Ruckmick's survey.

Although describing the same period of time, between 1875 and 1911, Garvey (n=68) mentions almost twice as many laboratories as does Ruckmick (n=37). While the most most general trend (i.e., that many laboratories were established) is the same for both sets of data, the details are quite different. Ruckmick's data show that 65% (n=24) of laboratories were established before 1900. This figure is in accordance with the number of laboratories we would expect if they were established at regular intervals of one per year, over 36 years. Ruckmick's data suggests therefore that proportionately the same number of laboratories were established before 1900 as were after this date. Garvey's data relate a different picture however, showing that only 51% (n=35) of laboratories were established before 1900. This suggests that proportionately more laboratories were established between 1900 and 1911 than in the period before the turn of the century

Two points can be drawn from this comparison. Because Ruckmick's data show that in proportional terms, no more laboratories were established before 1900 than after 1900, the general conception that most laboratories were established before 1900 is not supported. Garvey's data, however, demonstrates that the truth is even further removed from the general conception. His data shows that proportionately more laboratories were established after 1900, which effectively highlight the period between 1900-11 as being of more importance in terms of numbers of laboratories established over time than the pre-1900 period.

The two sets of data also reveal different patterns to laboratory establishments. Ruckmick's data present a rather flat, relatively even development of laboratories with foundings being within the relatively tight range of 0-3 per year. Garvey's data show, however, considerably more variability and lack of conformity, and a wider range, between 0-6 laboratory foundings per year.

Curiously, although Ruckmick's data is incomplete, it exhibits to some extent two of the three concentrations of laboratory establishments shown in Garvey's data. These periods are 1890-93 and 1900-2.

Looking at Garvey's data, it is clear that the main period of laboratory growth fell in the eight years between 1887-1894, when 27 laboratories, or 40%, were established. This was a period of rapid growth. It was followed by a quieter period and another burst of activity between 1900 and 1902. A final peak occurred in 1907 and 1908. It is tempting to attempt a more wide ranging interpretation, of this data, but I believe that such an attempt would be of little value at this point. Additional information, such as regional distribution of

laboratories, dates of laboratories closures, laboratory budgets and relative laboratory sizes are required before an adequate and meaningful interpretation can be offered.

The information available on general laboratory development does not end with the establishment of laboratories. Curiously, however, the secondary sources make this their primary focus. There are two exceptions. First, Albrecht (1960) gives some space to the sort of work that took place in laboratories. Second, Popplestone & McPherson (1984) offer a number of novel perspectives. Their work is necessarily exploratory, but they pose very good questions for future research and raise issues which deserve further, more in-depth attention. However, they seem not to have read a number of the primary sources, or even Albrecht, who devotes a whole chapter of his dissertation to laboratory development. While Albrecht (1960) includes all of the primary sources relating to laboratory development, he considers only establishments.

A closer consideration of the primary sources relating to laboratory development is therefore long overdue.

## The Ideal Laboratory

Information relating to the nature of the laboratory, both actual and ideal, is well supported by the primary sources, which are of two main types. The first relates to specific laboratories. These papers recount the specific details of actual laboratories. Without exception, accounts relate only to the bigger and more developed and well known laboratories. They tend, therefore, to appear in the later period of laboratory development, after the turn of the century, unless describing a German laboratory, in which case they appear somewhat earlier.

Of the papers I have access to, seven occur from 1900 or later, while only 5 occur before this time (two being German and one Canadian). Generally, the larger and more impressive, the longer its description.

Most of the purpose built laboratories occurred after the turn of the century, and it was these that psychologists were most proud of and therefore about which they were most likely to publish details. Another aspect of this latter publishing period, is that these laboratories were in effect the ideal laboratory made into reality. Earlier papers frequently described an ideal laboratory, incorporating all the best features of intended future laboratories, but which did not yet exist. These latter papers then, typically those appearing after the turn of the century, contained the embodiment of the earlier idealised laboratories, but in accounts of actually existing laboratories. By reading both the ideal and the actual laboratory accounts we can not only generate a picture of the laboratory as it was conceived by the Experimental psychologists of the period, but also how closely the latter reality matched the earlier idealisations.

The early laboratory papers, which tend to refer implicitly to the ideal laboratory, were typically written by men of considerable experience with laboratory work who had their own laboratories. For example, Scripture (1897) shares his experience of four years as a student in the Leipzig and Worcester laboratories as well as a further six years of experience with his own laboratory at Yale.

Titchener (1898a), however, makes explicit reference to the ideal laboratory.

And in a later paper Titchener notes,

> although the laboratory [at Cornell] is not yet completed upon the twelve-room basis, and although the various schemes thought of for an ideal laboratory have not yet matured into anything that could be put into an architect's hands, it still seems worth while, in view of the interest that the

> preliminary discussion has aroused, ... to outline the general conclusions that we have reached concerning the laboratory of the future (Titchener, 1900a, 252).

Interestingly, although he was quite clear about the ideal laboratory not yet existing, it is equally clear that he was of the opinion that when it did exist, it would be similar to his laboratory at Cornell.

Another feature of these laboratory accounts, was that they were written with the intention of informing and helping colleagues with less experience of laboratories or less resources at their disposal, who were either beginning their own laboratories or considering enlarging existing laboratories. Scripture (1897) writes his account hoping that his experience "may be of value to others." (93). Sanford (1893) offers advice about the general nature of a laboratory, which he hopes "may not come amiss to those having them in contemplation." (426)

This explains, then, the incredible amount of detail over seemingly mundane things that abounds in these papers. It must be remembered, however, that as the psychological laboratory was new, its entire structure and organisation had to be considered, including all the small details. An excerpt from Sanford's (1893) discussion of laboratory tables is illustrative.

> Some should be large (3x8 ft. or longer) and some small (2x4 ft.). If some are thirty-six inches high (for use when the experimenter stands), and others are six inches less (for use when he is seated), it will be well; and it will not be amiss if all are provided with drawers. It is convenient to have one or two very solid tables with square legs the same size at the top and the bottom, so that apparatus may be clamped to them. There should also be a few small tables that are adjustable in height (Sanford, 1893, 431).

Sanford continues for quite some time in this vein.

The principal accounts I draw upon which describe the typical laboratory are Sanford (1893), Scripture (1897) and Titchener (1898a, 1900a), although other papers provide additional or peripheral information. The conception of the typical laboratory can be divided into physical and organisational considerations. "Physical" refers to the laboratory building and general space available, the various rooms such as lecture, experimental, library and workshop rooms, apparatus (including fittings and furniture) and sources of power. "Organisational" concerns related to the type of institution the laboratory was associated with, the teaching and research functions, distinctions between levels of student, and the categorisation of apparatus.

For a psychologist attempting to establish or improve on an existing laboratory, it was vitally important to have detailed information of a reliable nature about the mechanics of the laboratory and its contents. This also explains the same richness in small details apparent in the papers describing actual laboratories. These papers, however, had the dual additional purposes of affirming that the ideal had been reached and drawing attention to the success of Psychology as a laboratory science.

## The Physical Nature of the Laboratory

I will now consider the typical physical and organisational features of the ideal laboratory.

Quietness was the most important general consideration. Because the allocation of space for the laboratory was decided at this time by what space was left over or not required by the natural sciences, the general qualities of quietness as well as ample light were considered as more important than the nature of the

surrounding building itself, which was "too often not under the control of those most interested" (Sanford,1893, 427). Scripture (1897) notes that "just as freedom from shaking is the indispensable condition for many physical experiments, so freedom from noise is the fundamental requisite for the successful prosecution of many psychological investigations." (96) Sanford considered quietness as absolute necessity: "what freedom from jar is to the physicist, [is what] freedom from noise is to the experimental psychologist" (427).

The top floor of a large building was favoured as the location for a laboratory, presumably because it was quieter and also had better light than other alternatives. Scripture (1897) suggests that "if possible the laboratory should be situated in a building back from the street, preferably in the suburbs". (96) Titchener (1900a) however wrote more in terms of a fantasy when he conceived of the laboratory occupying an entire three-story building, including the attic and basement. This arrangement, apart from providing plenty of space, would result in quietness and seclusion from other departments.

The laboratory was divided into rooms which served varying purposes. The three most important types of room were the lecture room, experimental rooms and a workshop. Consideration of the workshop will be included in chapter three, the first two will be considered here.

The lecture room was important because here students were presented with the facts of Experimental Psychology, and also the use of various apparatus and simple experiments were demonstrated. Scripture (1897) suggested that the key points to consider in the use of the lecture room were, lighting, seating arrangements (which should be such that every student can see - an important consideration in large classes), the magic lantern and the "experimenter's table".

The magic lantern was valued because it allowed for the showing of prepared slides, which could be on any aspect of Experimental Psychology, without the need either to set up apparatus for a display or even to possess the apparatus at all (see also Cattell, 1898b). Thus, the magic lantern was a cheap and easy means of teaching large classes. An anonymous writer (1888a) in Science laments that "the magic lantern is not yet sufficiently used by teachers of science" (9), but laboratory psychologists certainly appreciated the advantages of this device, if the recommendations of the papers considered here are any guide.The experimental rooms consisted typically of a number of small rooms, each devoted to a different type of experimental research. Sanford (1893) makes the point that

> a number of small rooms are better than an equal floor space thrown into one or two large rooms, for there are not many psychological experiments that can be made simultaneously in the same room without mutual interference (Sanford, 1893, 430).

Titchener's (1898a) account of a laboratory on a 12 room basis, includes rooms for optics, acoustics, haptics, reaction, and taste and smell. In short, each experimental room was devoted to a different sense or at least, a different aspect of experimental psychological research. Scripture (1897) suggested an isolated room, "where the person experimented upon can be kept indefinitely in perfect external darkness and quiet" (100) as well as an optical room and a time room (similar to Titchener's reaction room).

The amount and physical nature of the laboratory space available decided to some extent how rooms were divided as to purpose. In a smaller laboratory, there would be some sharing of a room's function, or they may even have been a general laboratory room where any sort of experiment could take place. In

fact, Sanford (1893) recommends this, in addition to a number of smaller rooms "that can be used, though not exclusively, for special purposes" (430).

Titchener (1900a) however, in his description of a laboratory in a three-story building, advocates more separate rooms, each with more specific functions. For example, there are two optics rooms, one light and the other dark. Acoustics requires a large room with an adjoining soundproof room. Haptics is served by one room for "cutaneous pressure, temperature, and pain" and a second for "investigations of the movement perceptions", and so on. This wishful thinking on Titchener's part, demonstrates that the desire was not only for increasing space within the laboratory, but also for increasing division and specialisation of that space.

This general plan of the arrangement of rooms, although a popular ideal, was not universally accepted. Cattell (1898b) contended that it was better to have separate rooms, but not to designate them for any particular function. He points out that the amount of work done in any area will vary from year to year and so, when rooms are only to be used for a specific function, they may be underused in some years, overused in others. He wrote,

> In some years there may be several researches in progress on vision and none on hearing ... a room for taste and smell can scarcely be used continuously for research, and a special room is not needed for an hours instruction in the course of a year (Cattell, 1898b, 655-56).

Additionally, as regards the teaching function, Cattell (1898b) considered that a general experimental room was best for the conducting of experiments by students, because, "For instruction it is not desirable to drive a flock of twenty students successively into different rooms" (656).

Despite these criticisms however, the general rule of a laboratory divided into numerous rooms, each used for different sorts of experiments, remained the norm. The possibility of having rooms with interchangeable functions did not alter this basic conception.

Other rooms, which were not experimental or lecture rooms, were related to the administration or the running of the laboratory. There were rooms for the director and staff, perhaps a student workroom, a library, storage space, apparatus storage and a room for a centralised power (electricity and battery) system.

An important part of the laboratory's functioning was its apparatus. Apart from the laboratory itself, apparatus was what identified Experimental Psychology as such. It was frequently expensive, especially when it had to be ordered from overseas and it was cared for with great feeling. Apparatus will be considered in a later chapter, but here it is appropriate to offer some description in terms of the laboratory. All writers consulted agree that the apparatus of a laboratory should be carefully stored and cared for, best in a special room or area of the laboratory. Scripture (1897) suggests a room not used frequently "on account of moisture and dust." In this regard, he recommends a wooden floor which should be cleaned with a damp cloth. Additionally, apparatus should be kept in cabinets "with glass doors which should be kept tightly closed." (100)

Scripture suggests further that a record of each piece of apparatus should be kept, relating to "its purchase, its use, its constants, where it is to be sent for repair, where to obtain parts, where to find literature on its use, etc." (100) Titchener (1900a) designates the special room for apparatus as the "museum room, a room devoted to the display of historical instruments, the storage of the demonstration-pieces required for lecture courses, and the safe-keeping of all

apparatus not actually in use in the laboratory." (252) He viewed this special room as a safe place for apparatus, but additionally it was a central repository for apparatus which meant that it was easier for students to engage in the "wholesome labour" of returning all instruments to this room after use, instead of leaving them about the laboratory. Such activity he considered as a great protector against "slovenliness and lack of method in experimental work." (252)

Probably the two single most important pieces of apparatus were the Chronoscope and the Kymograph. The Chronoscope in all its varieties was for measuring reaction-time accurately and precisely. One example was the Hipp Chronoscope which was accompanied by various peripheral devices allowing for its fullest and most proper use. Sanford (1893) notes that while the Hipp Chronoscope cost about $70, the other associated pieces, such as "batteries, testing apparatus, electric keys, commutators, etc" (434) add to $100 - more than the worth of the Chronoscope itself.

The Kymograph allowed for visual records of movement to be made. Ancillary equipment required "to get the full advantage of this central piece" wrote Sanford, included "two or more electrical time-markers, an electrically excited vibrator and a tuning fork of 100 v.d. per sec., Marey tambours, etc." (435)

Both the Chronoscope and the Kymograph were able to be used for a variety of research functions and hence were staple devices for experimental psychological research. Further discussion of these instruments is to be found in chapter five. Other psychological apparatus can be divided into groups depending on specific function, but the simplest division is by the five senses. Writers invariably

made their own idiosyncratic categories, but the categorisation of apparatus as a function of its relationship to taste, smell, optical, auditory or haptical research is the most truly broad and representative division. Included in this apparatus were such static pieces as models (such as of the brain or optical system) and charts (such as that mentioned by Titchener, 1900a, "showing localization of cutaneous impressions" (261)).

Another type of apparatus was not psychological as such. It consisted of general equipment that was likely to be found in any laboratory. Included in Sanford's list of such apparatus are stands, rods, clamps, a motor, beakers, flasks, rubber tubing, sheet lead, coloured papers, pins, needles and thread. Clearly his definition of what constituted apparatus was rather broad, as it includes what might be ordinarily considered as construction materials and even sewing accessories. He also includes general office equipment such as wastebaskets, dustpan, brush and china plates as general apparatus. It seems that the definition of apparatus was extended so as to refer to almost anything that was used in the laboratory. This use of naming reflects the scientific zeal of experimental psychologists at the time who tended to define everything they used (and did) in terms of the laboratory.

Power and its forms was an important factor which underlined the smooth running of the laboratory. While Sanford (1893) merely makes a cursory note that lighting (along with the other mundanes of heating and ventilation) "are important in all study rooms and a fortiori in rooms where bodily conditions must be kept constant and prevented as far as possible from disturbing mental conditions" (430), others give more detail, especially Titchener. Titchener (1898a) himself devotes almost two pages to "gas, water and electric fixtures" (317). While batteries were considered a necessary evil in cases where their use could not be avoided, as much effort as possible was put into replacing them by

direct current. Primary batteries were only required by Titchener (1898a) for "the ringing of signal bells and for our telephone circuit" (318). Primary batteries are described as "more troublesome than serviceable." Storage batteries were also used, for example, with the Hipp Chronoscope. Direct current was used in all cases where it was practicable, and when storage batteries were required, the direct current was used to charge these. Also described is the laboratory wiring system which connected rooms to current from a central switchboard. Scripture (1897) refers to this as a "central station" and compares it to a telephone switchboard, which was known for its order and efficiency among telephone users.

## The Organisation of the Laboratory

There were a number of levels involved with the organisation of the laboratory. These involved, the type of laboratory (college or university), the dichotomy of research and teaching, the distinction between undergraduate and graduate, and the categories apparatus could be placed into depending on their users and their aims. (Note that this categorisation of apparatus is distinct from that based on the type of research it was used for. These categories will be discussed in the following chapter.)

Scripture (1897) makes a distinction between college and university laboratories. He saw the difference as involving not only the size and resources available (the university laboratory typically being superior in both respects) but also the attitude and mode of instruction, along with the need for research. In the college, "The aim is to provide an outline-knowledge of the subject sufficient for general culture. Research or advanced courses are quite out of the question"

(Scripture, 1897, 93). A collection of simple apparatus was recommended as sufficient for the college, depending on its size.

The university laboratory catered for a wider range of needs than the college and also had to offer the possibility of research. The students were of two basic types. First, were those whose major was Psychology. Second, were students who took Psychology as an adjunct to some other subject which was their speciality. For the latter group, a general course of instruction was suggested including laboratory work. Psychology majors however, required additional instruction. As well as an introduction to "the theory of statistics and measurements" (Scripture, 1897, 95). Scripture recommended some training in the technicalities involved with apparatus construction, care and design.

A similarity between both the college and the university laboratory, was the existence of competition for students among science departments and the possibility that students would draw comparisons between departments, with the accompanying possibility that they would be attracted to the departments that had the most to offer.

> Comparisons are constantly drawn [by students] between the various departments, and merely as a matter of self-preservation the psychological laboratory must offer courses equal in attractiveness and value to those of physics, chemistry and biology (Scripture, 1897, 94).

Included in students' comparisons were not only the quality of lectures and course content, but also that of the laboratory facilities and apparatus available. Noting that the situation was even more pronounced at the university, Scripture (1897) pointed out that the university student "demands the best instruction. Moreover, if the other departments, such as physics can show better, brighter

and more numerous pieces of apparatus the students are apt to draw disparaging conclusions." (94-95)

The teaching-research dichotomy, pointed out Titchener (1898a), was a distinguishing characteristic of the Psychology laboratory in America. The German laboratories were largely research based, with students learning by participating in ongoing research. While students also attended lectures, these were closely related to the requirements for doing research. The American laboratories however, made a strong distinction between their teaching and research functions, although both took place in the laboratory. While some teaching was by lecture or demonstration and may have occurred in a lecture room, this room was a physical part of the laboratory itself (as noted in the previous section on the physical nature of the laboratory). This structural consideration was in itself a statement of the central importance of the laboratory on all aspects of Psychology, including teaching by lectures. This may be interpreted as one further aspect of Experimental Psychology's attempts to distance itself from Philosophy. Teaching by lecture was of course the standard method of instruction in Philosophy. Experimental Psychology utilised the lecture method also, but by locating the lecture room within the confines of the laboratory, the Experimental Psychology lecture was considered as scientific. That is to say that by the mere location of the lecture in the laboratory, Psychology became more akin to the natural sciences than it was to Philosophy. Also, the nature of the Psychology lecture was changed, so that it involved the use of apparatus in the lecture room itself, which made Psychology lectures more like the typical science lecture than anything to be found in Philosophy.

The undergraduate Psychology program mostly consisted of teaching, with research generally being undertaken by post-graduates or senior undergraduates.

Not without dispute, however, was the form that the teaching of undergraduates should take. Titchener believed that undergraduates should have the opportunity of doing a course of laboratory work, which he saw as essentially preparation for conducting actual research in later years. Cattell (1898b) on the one hand supported this approach, but on the other questioned it. He recounts that a Physics professor he knew "did not want to turn his students into the laboratory until they had followed a 4-hour course of lectures through the year." Cattell reasoned, therefore, that

> In Psychology where the experiments are in a way less fundamental and have scarcely as yet been perfected by the survival of the fit, this point of view is even more tenable (Cattell, 1898b, 656-657).

He suggested keeping lectures independent of laboratory work as a solution.

Wolfe (1895) writing a few years earlier, pointed out that,

> in nearly all large universities of the East, Experimental Psychology is considered a post-graduate, or at least an advanced philosophical discipline. Students are admitted to its work ... generally after work in other lines of philosophy (Wolfe, 1895, 384).

He supported the teaching of Experimental Psychology in undergraduate work, however, because of its positive influence on Philosophy students. According to Wolfe, this positive influence consisted of Psychology's grounding in facts and its absence of speculation, of which the latter was too often found in Philosophy.

As Experimental Psychology established and entrenched its position in the university, it was offered to increasing numbers of students and included increasingly the more junior students. The trend then, was to supply undergraduates with a combination of lecture and laboratory work.

The form this teaching took, has been outlined by Titchener (1898a, 1903). He divides teaching into two parts. The first is the class experiment, the second consisted of drill work.

Class experiments were a modified form of the standard lecture, so as to include demonstrations of apparatus and experiments in front of a whole class. As was noted earlier, this, along with the positioning of the lecture room in the laboratory made Psychology more like a science.

> Now that psychological instruction centres in the laboratory, rather than in the library, it is but natural that the old lecture courses should be replaced by courses in which demonstrations, class experiments and the projection lantern figure as largely as they do in elementary physics or elementary zoology (Titchener, 1903, 175)

He mentioned two possible types of class experiments. Both of which involved the instructor conducting an experiment in the large classroom. However one of these types treated the class only as observers, rather than active participants in the experience of the experiment, which Titchener found to be objectionable, because it was therefore no more than a simple demonstration. Although there is nothing wrong with a demonstration of how apparatus worked, and how one should best operate it per se, it was when this was offered as if it were really an experiment, that he took exception. Titchener viewed this type of class experiment as not in any sense a "true" experiment, which was after all what Psychology is attempting to teach.

He takes the example of an instructor who takes his own reaction time as the basis for a class experiment. If,

> I set up a reaction apparatus on the lecturing table, take my own reaction time, and write the sigma on the blackboard, I have made a mere demonstration. The class has seen the hand of the large clock start, and

> seen it stop; but no one, save myself, has any idea of the contents of the reaction consciousness (Titchener, 1903, 176).

A true class experiment involved not only the performance of an experiment in front of a class, but also the active participation of the students' individual consciousnesses. The necessity for this participation lay with the aim of Psychology classes, which was to teach Psychology. This aim was not fulfilled when class experiments were not also "true psychological experiments" (177).

It has been noted by others (eg., Brown & Fuchs, 1979) that Titchener's view of Experimental Psychology was not especially representative of most American experimental psychologists. He was inclined to subordinate everything to the duty of introspection. Possibly therefore, the distinction he made between two sorts of class experiments was not generally agreed upon. Given that information to the contrary is not, however, available, it can be surmised, that the trend in class experiments was towards the type of class experiment that Titchener found to be objectionable. As the numbers of students in Psychology increased, so to did the numbers attending lectures with these experiments increase. This would necessarily have mitigated against the full participation of the class. Additionally, as Titchener's view of Experimental Psychology was not necessarily typical, other approaches, focussing more on the apparatus, its use and the results obtained, rather than the processes involved with the experience of the experiment, would have been quite acceptable.

Interestingly, Titchener himself initially rejected the class experiment in any form. In his 1898a paper he points out disparagingly that the class experiment "is necessitated by an overcrowded laboratory and a small teaching staff" (322). He was against the class experiment because it was time consuming for the director when he had to take such classes and also for the student because,

> he receives no individual instruction, and has to perform his experiments in a disturbing environment, and without any of that freedom of speech and movement which is one of the great charms of laboratory work. Hence, I can say nothing, from personal experience, of class experiments (Titchener, 1898a, 323).

However, only five years later, (Titchener, 1903) Titchener was openly advocating the class experiment and outlines in detail the sort of special apparatus required. It is this change of opinion that probably resulted in his strict distinction between two possible types of class experiment. It seems that he was overtaken by events and so, although he then became an advocate of class experiments, felt perhaps that he needed to make it clear that he didn't favour all such experiments.

The other type of teaching, apart from class experiments, was drill work. This had more in common with research than class experiments as is shown by Titchener's (1898a) description, "students are paired off, two and two, precisely as they would be in research work" (322). The experiments performed were however, only repetitions of previous research, which demonstrated a particularly important psychological point, or were of some other educational value, or merely gave practice in using a certain piece of apparatus. The drill work usually utilised cheap or homemade apparatus. "Instruments that are cheap enough to be bought by the half-dozen" (Titchener, 1903, 322) were necessary because a large number of students were being catered for. It was held that the ideal of any Experimental Psychology major was research (Scripture, 1897), hence drill work was considered as a natural training for this.

# Actual Psychology Laboratories

Accounts of actual laboratories, after 1900, are almost identical in principle with the accounts provided by those who earlier outlined the ideal laboratory. Where they differ, it is because actual laboratories were more well-funded than could have been imagined, and therefore bigger, with more rooms, more apparatus, and indeed more of everything. The tone of these descriptions of actual laboratories is one of confident familiarity with what was involved with the Psychology laboratory. This contrasts with the tone of articles written when the laboratory as a functioning entity was still a new idea in Psychology. At this time, before the turn of the century, the way of organising, operating and arranging the laboratory was open to doubt, discussion and debate (sometimes heated). However, as the laboratory became more common and informal norms became established as to the best way of running a laboratory, this time of doubt passed. In these reports of actual laboratories, there is no evidence of a need to justify the existence of the laboratory, or to discuss how it should function. These were now largely givens. Because the requirements of a typical laboratory are accepted without question, the purpose of these accounts is to triumphantly herald the achievements and the advanced nature of the Psychology laboratory's development. This suggests that articles describing laboratories were performing different functions, depending on when they appeared. The early papers, before 1900, served to provide information for others establishing or improving their own laboratories. In a sense, this performed a necessary socialisation function for an emerging discipline that wanted not only to establish a place for itself, but also to have some uniformity amongst its constituents.

Interestingly, I have not located even one pre-1900 paper involving just a straight forward description of an American laboratory. I have a number with

such descriptions of German laboratories, and one such for a laboratory in Canada. These accounts of foreign laboratories were functioning as straight models to be copied. All of the papers in this time period describing American laboratories, always included attempts at providing advice as to how best to arrange and operate a laboratory. These were attempts at reaching an ideal, although always based on the experience of the writers in real laboratories. Later articles however, included none of this idealisation component. They were no more than descriptions, although they also made glowing references to the success of Experimental Psychology as a laboratory science.

## Three Stages of Laboratory Development

Three stages of the development of Psychology laboratories can be identified based on the physical features of the laboratory. It is useful to identify stages in the development of laboratories, because, by so doing an insight into their evolution may be gained. The physical correlates of the laboratory provide a relatively easily verifiable indicator of development, to which may be related other more complex indicators such as status and acceptability. It is also important to point out that the development of laboratories was not merely a matter of establishing laboratories. It was more complicated, involving a process or evolution which was not only qualitatively but also physically different at different points. The process of development was also not so simple that it can be related merely to a linear time frame - although time was a major factor.

The first stage typically involved early laboratories, such as that of James or Titchener for example. These laboratories were located in space that no-one else wanted, which is to say that it was available because it was undesirable. Such

space as basements, attics, storage rooms and cupboards under stairs were all common places for early laboratories. William James' first laboratory, for example, was located in two basement rooms (Harper, 1950). Popplestone & McPherson (1984) note the difference between early Psychology laboratories and the science laboratories of the time. They seem to suggest that psychologists held a different definition of what constituted a laboratory from that held by the natural scientists. This difference, I believe, is due to the contextual demands on psychologists, which forced them to define an attic or such other peripheral space as a laboratory. It was in the pioneering environment of the early laboratories that such a view had to be taken. It was not until the second stage that psychologists actually had rooms which would commonly be considered worthy of the name "laboratory". But in order to be eligible for these, they had to first demonstrate that Psychology was a laboratory science and therefore worthy of laboratory space.

The second stage was a move upwards for Experimental Psychology. It showed that the discipline was accepted as a laboratory science - if that can be defined by having a proper laboratory. Titchener's laboratory and also that of Scripture before 1900 are both examples of this stage. The difference between the first two stages is not always clear-cut. Having a proper laboratory space was not however the same as the ideal laboratory.

Stage two involved a more desirable location, generally involving rooms vacated by other more well endowed disciplines as they moved to still better quarters. These rooms, while of the order of proper laboratory space, were not however purpose built for Psychology. They were considered as a great movement forward for Psychology, but at the same time, as improvisations until the ideal Psychology laboratory could be attained.

The third stage was when the laboratory moved into its own purpose built space. This was perhaps a new building or part of such that had been built with Psychology in mind, or even better, designed and built to accommodate the specific needs of a Psychology laboratory.

Psychologists at the time were not unaware of the predicament involved with the first two stages which involved "making do". Sanford (1893) acknowledged that Psychology had to be content for its laboratories to use whatever space was available. "As a younger member of the family of sciences, Psychology must be content with the outgrown clothes of its elders" (Sanford, 1893, 429). Lamenting the fact that Psychology in America had no purpose built laboratories, which is to say that it had not as yet reached the third stage of its development, Titchener (1898a) appraised the situation realistically when he wrote, "everywhere indeed, psychology has come late to the feast, and been obliged to content itself with what it can get" (314).

Stage one was associated with a struggling new discipline as reflected in the space made available to it. An example is the laboratory of William James, who started with two rooms in a basement (Harper, 1950). Popplestone & McPherson (1984) make some mention of the difference between early Psychology laboratories and those of the established sciences. They suggest however, that the different existed because psychologists held a different definition of what constituted a laboratory from that of the natural scientists. This difference in "definition" was due to the contextual demands on experimental psychologists, which forced them to define an attic or other such peripheral space as a laboratory, rather than some internal peculiarity of the psychologists of the period. It was not until the second stage, that psychologists

actually had rooms which would be commonly considered worthy of the name of "laboratory".

The second stage was a great move upwards for the Experimental Psychology laboratory. It showed that the new Psychology was now a proper laboratory science - if that can be defined by having a proper laboratory. Titchener's laboratory and also that of Scripture, are examples of this stage. However, note that the difference between stages one and two are not always clear cut.

Having a proper laboratory space, however, was insufficient for Experimental Psychology. The aim was, always, that once it had established itself, to have laboratories especially constructed for Psychology. Represented by the third stage, this was the ideal that the new Psychology reached for. It should be remembered however, that the ideal of the laboratory involved more than just the laboratory. It included the associated things such as increased funding, more staff, higher status both inside and outside the university and so forth. The usefulness of the stages outlined here involves more therefore than the laboratories themselves. They also offer a verifiable measure that is related to characteristics such as status, which are important to any developing discipline.

One example of this third stage, was a new building designed to house the laboratory at Princeton and opened 1924 (Langfeld, 1926). Previously the laboratory was housed in a couple of rooms, "but these quarters were very inadequate both as to space and general arrangement" (259). These earlier quarters possibly represent stage two, while the new building, designed and built especially for Psychology relates to stage three.

Another, earlier example, was the laboratory at the Leland Stanford, Junior, University. It was built in the years before 1906 (Martin, 1906) and also

represents stage three, because despite its early time, it was along the lines of an ideal laboratory. Other examples, such as Reymert (1928) are not so obvious. He writes of the new Psychology laboratory at Wittenberg College, which is "located on the third floor of a new building that is shared by the departments of chemistry and Psychology" (171). It is not clear whether the building was specially constructed for Psychology, but in this case, that would seem to hardly matter, as the building was new and the tenancy was shared with a natural science.

# Chapter Three

## The Historical Appreciation of Early Psychology Apparatus

Apparatus was an important defining characteristic of the New Psychology. While laboratories provided its physical and organisational structure, apparatus was the major content of the laboratory and thereby the tools of trade of the new psychologists. Everything that they did in their laboratories, whether teaching or research, involved apparatus. A few examples illustrating this are given below.

Ruckmick (1926) recognised the place of apparatus when he measured the progress of Experimental Psychology by accounting for the value of the apparatus in Psychology's laboratories. While acknowledging that "apparatus does not make a science" he pointed to the central importance of apparatus to the New Psychology by suggesting that,

> in the same sense that the material aspects of a community reflect its prosperity, so the continued demand for apparatus is a fair indicator of the health and vigour of the experimental method (Ruckmick, 1926, 582).

The Encyclopaedia Brittanica (1911), referring to the New Psychology, sums it up as "largely a matter of experiment and apparatus" (604).

Early psychological journals such as the American Journal of Psychology indicate that apparatus was of underlying and central interest to experimental psychologists. This indication arises not only from the research articles in

which apparatus was used, but also from articles devoted to the theme of apparatus per se. The journals are so replete with articles such as these, that one can find them in practically any volume of the period, a point not overlooked by Popplestone & McPherson (1971). They noted as early as 1971 that "during the first years of its existence [the American Journal of Psychology] consistently reported instrumentation." (657) The examples I mention here are chosen then for their illustrative value rather than to be representative.

Titchener (1904) offers an article describing a new Whipple gasometer, and an improved version of the disc cutter - a device for cutting of coloured paper into a circular form suitable for use with a colour-mixer. Bergstreom (1903) describes in a not insubstantial 30 pages, a modified ergograph, which measures "muscular strength and endurance" (246).

Often reports were quite short, as was the case with Bentley (1909) detailing an observational table; Titchener (1909) revealing a demonstrational stereoscope, which was little more than a mounting of three existing pieces of equipment onto a common base; and Titchener & Whipple (1909) suggesting the use of modified tuning-forks for pitch discrimination.

Laboratory manuals, effectively handbooks of the New Psychology for novitiates, offering as such a distillation of important research and research techniques, may be viewed as little more than catalogues of apparatus and description of what could be done with them.

It was not enough to have an idea for research; one had to have the means also of doing the research. Titchener (1898a) made it clear that, "it is of little use to have ideas, if you have no means of realising them in brass and steel" (320).

Despite the varied sources presented here, indicating the importance of apparatus to the New Psychology, the History of Psychology has taken little cognisance of the place of apparatus. This omission has been noticed by Popplestone (1980) who pointed out that although historians have recognised the New Psychology itself as an important stage in American Psychology, they have typically only been concerned with writing intellectual and 'great men' history. This approach has resulted in the almost complete neglect of the apparatus of the New Psychology and the practices associated with its use.

No explanation has yet been attempted to explain this neglect, although Popplestone & McPherson (1971) describe it as paradoxical, "in as much as the adoption of a technology was undoubtedly highly influential in Psychology's relinquishing identification with philosophy in favour of pursuing admission into the scientific community." (656) Despite the general silence over apparatus, it has received treatment of a limited sort over the last 25 years. The start of this treatment can be traced to three events in the mid-1960's (Davis, 1970). These were, the establishment of the Archives of the History of American Psychology with its activity of preserving and encouraging the study of early Psychology apparatus (Cohen, 1991); the foundation of the History of Psychology Division of the American Psychological Association; and the American Psychological Association's celebration of its 75th Anniversary with, in part, a display of early apparatus.

Articles considering apparatus have been of four general types. The first type was associated with an apparatus display or exhibition and attempts a description of the pieces on display and also gives some consideration to their collective history. Davis & Merzbach (1972) describe an assortment of graphic recording devices on exhibit and the idea behind the Kymograph. McPherson,

Popplestone & Whitmore (1967) provide a catalogue to accompany a display of apparatus at an American Psychological Association convention. Davis (1970) refers to a commemorative display to mark the 75th anniversary of the founding of the American Psychological Association.

The second type of article involves description of either a single piece or a variety of apparatus, or equipment associated with a common function, such as memory (Popplestone, 1985) or auditory research (Davis & Merzbach, 1975). A different approach was taken by Popplestone & McPherson (undated) who showed that a variety of early apparatus is still being used by contemporary psychologists in some form. By so doing, they hoped to inform psychologists about the instruments "that initiated and thus shaped, in part, numerous features of the current scene." (226)

The third article type attempts a more general historical and sometimes sociological analysis of apparatus and its place and development in the New Psychology. These articles (Caudle, 1983; Popplestone & McPherson, undated, 1984, 1971; McPherson & Popplestone, 1984; Popplestone, 1980; and Sokal, Davis & Merzbach, 1976) are of particular interest because of their approach, which will be extended later in this chapter. The fourth article category relates to the preservation of apparatus, description of which is included in chapter five. It should be pointed out that the division made here between different article types is for ease of description, and that the content of articles from different categories is to some extent shared.

Probably the feature of Psychology apparatus that has captured the imagination of these writers most, is the aesthetic value or nature of the apparatus. Writers have been impressed by this nature and the difference in appearance of early apparatus from contemporary equipment (Popplestone & McPherson, 1971).

Caudle (1983) writes that modern apparatus "are not as elegant as those of our predecessors - brass and polished wood have regrettably given way to plastic and stainless steel" (26). The strong impression early Psychology apparatus have effected may be the reason why these writers have made the attempt to seriously consider apparatus in Psychology's history. The apparatus, when viewed on display, has an effect on its viewers, as does any historical exhibition, of confronting them with physical evidence of a time which is now past. For psychologists, the apparatus are a physical and living representation of a period from their discipline's past. Davis (1970) illustrates this with his description of an apparatus display,

> Displayed in a darkened room, each instrument stood on a separate cylindrical pedestal lighted from above by an individual spotlight. The effect was that of a field of monoliths, each supporting a lonely survivor of the past, isolated in space and suspended in time (Davis, 1970, 606).

Apart from being comparatively more aesthetically pleasing, writers consider the New Psychology apparatus as also intrinsically pleasing to the eye. Popplestone & McPherson (1971) write that early apparatus

> impress one with their beauty. Their resemblance to the tools of the seventeenth- and eighteenth-century is obvious, yet they have a nineteenth-century character of massiveness. Even though of impressive size, they retain a prior concern with aesthetic surfaces, color, and elaboration (Popplestone & McPherson, 1971, 656).

Davis (1970) conveys the same theme with his general description of an apparatus exhibition.

> The instruments are glinting brass and steel, mounted on solid cast-iron legs, occasionally embellished with touches of Victorian elegance, create the image of ponderous self-assurance of late nineteenth-century psychology (Davis, 1970, 606).

Popplestone (1980) points out that the apparatus,

> speak strongly ... of the beginnings of the discipline. The pieces are decorative, elegant, massive, of sturdy construction and stand not merely as tools but as affirmations of the importance of the work being done (Popplestone, 1980, 159)

There is some evidence that the new psychologists themselves were similarly impressed by their own apparatus and that they took considerable care of it. Popplestone & McPherson (1984) for example, refer to a letter written by Boring, in which he describes Titchener's treatment of apparatus. '"The way he would tenderly unscrew a screw with affection for every knurl in the handle always made you feel that the apparatus was a lovely, tender, and sweet thing."' (202) Others have suggested that experimental psychologists were more concerned with the treatment and care of their apparatus than with the experimental procedures themselves. Popplestone (1980) suggests of apparatus that,

> evidence is accumulating that in early investigations precision was concentrated around its use. Other procedures - for example, subject treatment, stimulus exposure and intertrial intervals - were inconsistent and, at times, capricious, but the instruments were handled with care, conscientiously calibrated, and the mechanical regulation was maximal for the technology of the era (Popplestone, 1980, 159).

Popplestone & McPherson (1984) make the same suggestion.

Given this pre-occupation with aesthetics among historians, it is important to pose the question of how much their impressions of early apparatus are merely a reflection of their position in time and how much arises from the properties of the apparatus themselves. That is to say, do the contemporary writers consider early apparatus elegant and beautiful because of the comparison they make with contemporary apparatus, which is described as "both efficient and utilitarian and

looks that way" (Popplestone & McPherson, 1971, 656) or because the early apparatus is really intrinsically elegant? Although it may be argued that any matter of aesthetics is related to the individual making the judgement, in the context of historical appreciation it is only relevant to consider how the new psychologists themselves viewed their instruments. Understanding of this is not furthered by the apparently personal pronouncements of contemporary psychologists. Some evidence suggests that the new psychologists did in fact concur with the contemporary opinion, but this needs to be thoroughly researched and documented.

The aesthetic qualities of early apparatus, although a common thread, has not been a major area of study. Only two areas have received substantial treatment. The first is description of the workings and description and development of particular pieces of apparatus or apparatus grouped by subject matter. The second area concerns the development of apparatus in general terms, from the viewpoint of the American Psychology scene. It is to this second area that we now turn. I aim here to consider the development of apparatus in America from two main perspectives. Firstly, an identification of the processes involved in the development of Psychology apparatus will be suggested. Secondly, the nature and roles of two groups involved with apparatus development - psychologists and mechanicians - will be outlined. Additionally, the place of the workshop will be considered.

## Processes Involved with Apparatus Development

Popplestone and McPherson have contributed the bulk of this work. Looking at the development of Experimental Psychology apparatus in America from the

viewpoint of an imported discipline becoming increasingly indigenous, they have identified some of the characteristics of the developmental process. However, they have not attempted a systematic delineation. It is necessary to have some grasp of the processes involved, so that further research has some framework to follow. What is attempted here, is the identification of as many parts of the process that could be conceived of. Where historical information is available, this is used to illustrate the part concerned. It is for later workers to use this prolegomenon as a guideline to examine the historical record in depth and discover the relative importance, the order of the processes and to provide the detail necessary to further our understanding of the development of apparatus and its place in the New Psychology.

There are two different sorts of development process. The first is a general process, the second is specific to a particular country or geographical area. Both types will contain similarities and differences. Of concern here is the latter type, as it relates to apparatus development in America.

A number of explanations have been offered to explain Psychology's initial use of apparatus. These explanations will be mentioned here, before the processes involved in the development of apparatus are considered. The major reasons for the use of apparatus involve Psychology's break with philosophy and its consequent attempts to associate itself with the natural sciences (Popplestone & McPherson, 1971). The association with science involved both positive and negative aspects. Negatively, the new psychologists saw that they could make the break with their parent discipline more effectively if they eschewed as much as possible, the methods and ideas of philosophy. They hoped that by adopting the implements and techniques of the sciences, Psychology would became scientific. Positively, psychologists were concerned with increasing their status as a discipline by aligning themselves to the sciences. Davis (1970) points out

that Psychology "was striving to attain the status of a laboratory science, a discipline distinguishable from physiology on the one hand and philosophy on the other." (603) Related to this to a certain extent, many considered that a Psychology that dealt only with objectifiable facts and experiments was desirable and in accordance with the modern world. The society at the time was one that gave high accord to mechanical contrivances and treatments (de Vries, 1973; Popplestone & McPherson, 1984).

The apparatus that psychologists used initially, was derived largely from the sciences of Physiology and Physics. This had a lot to do with the physiological nature of the New Psychology ('physiological psychology' was a synonym at the time for New Psychology (Sokal, Davis & Merzbach (1976)) whose roots can be traced back to early workers such as Fechner and Helmholtz (Davis, 1970). Another consideration was that the early psychologists were naive about experimentation and instrumentation, and so found it easiest merely to borrow existing apparatus from well established sciences (Popplestone & McPherson, undated). The most outstanding feature of American Psychology's use of apparatus was that the New Psychology was centred principally in Germany, so that the ideas and the hardware of the emerging discipline were initially imported. The very specialist apparatus required, such as the Hipp Chronoscope, was simply unavailable in America. Other apparatus of a more general or supporting nature, such as clamps and batteries, were however capable of supply within America. Initially, there was a dichotomy between specialised, imported apparatus and general, locally available equipment. There existed however, other sources of apparatus. A common practice was to borrow

from one of the natural sciences, such as Physics. This was made practicable given the emphasis of the New Psychology on physiology and the senses and the similarity of the perceived needs of the two disciplines. It was also a means of making use of the apparatus collections of the natural sciences, which were by this stage not only well established (Guralnick, 1975) but were also readily accessible. To a relatively impoverished discipline such as the New Psychology (Ruckmick, 1912), the collections of the natural sciences must have represented a great storehouse of equipment just waiting to be put to use in the labour of their own goals. The natural science apparatus was a locally available source of apparatus and an indicator of the initial closeness of Experimental Psychology to Physics and Physiology, but it was also a temporary measure.

Other sources of ready-made apparatus were not ignored. The remarkable quality of the early period, was that psychologists utilised equipment from a wide variety of sources (MacDonald, 1905; Titchener, 1900b). They had particular research requirements which they satisfied where ever possible with existing apparatus, this being the easiest course. Some of this apparatus originated from the natural sciences, while other apparatus came from apparently unrelated areas and even from the non-academic realm (Caudle, 1983). Titchener (1903) for example used colour charts acquired from artists' suppliers, because such charts were obtainable nowhere else. Although "not designed for psychological ends", Titchener found them to be "very useful in the psychological laboratory." There is also the well known example of the Stereoscope, a device for parlour-room entertainment, which was adopted by psychologists. Other pieces, such as the Tachyscope and Kinetoscope (de Vries, 1973), which were not scientific apparatus, were adopted by Psychology in the study of illusions.

The psychologists conferred on the apparatus they collected and used for their own purposes, a new and special value. This value was based on the fact of putting the apparatus to a purpose other than that intended by its original creators. Additionally, the activity of unifying many isolated instruments under one discipline resulted in their redefinition as Psychological apparatus. As this co-option of apparatus continued, Psychology was able to collect a body of existing apparatus that was in a sense, unique to itself.

The adoption of non-scientific apparatus is particularly interesting, because it implies that the underlying motivation of psychologists relating to their use of apparatus was not merely the gaining of the scientific status associated with scientific apparatus, but the use of any apparatus, regardless of its origins. It has been suggested that psychologists used apparatus from the sciences because of the status it conferred on its users. This explanation does not, however, apply to non-scientific apparatus. A more general and inclusive explanation of psychologists' adoption of apparatus was simply that apparatus per se was considered important. Given that apparatus came from a wide variety of sources (a point ignored by previous writers), perhaps it was more important for psychologists to have any sort of equipment that satisfied their needs, regardless of origin. Another possibility, is that initially apparatus came largely or only from the sciences and at some later stage, as Psychological research progressed and new needs became apparent, any sort of apparatus was considered for use. To decide between these alternative interpretations requires a close inspection of the historical evidence. The answer, whatever it is, will reflect not only on the extent of the New Psychology's concern with conferred natural science status, but also on the degree to which the general societal trend at the time towards the adoption of mechanical and technical solutions, was responsible for Psychology's use of apparatus, and the form this use adopted.

Another source of apparatus was the Psychology laboratory itself. Given the availability of a workshop and the technical skills necessary, it was entirely possible for apparatus to be manufactured in the laboratory. This could take the form of building copies or effecting modifications to existing apparatus, or the invention and construction of wholly new equipment (Caudle, 1983). Because other laboratories were also doing this, a further option was to buy apparatus from another laboratory. This was generally at cost price, but when this service was not offered, designs of apparatus were sometimes made available instead. An example is the Yale Laboratory, which offered to supply blueprints of "the working-drawings of any of the special Yale pieces" to experimental psychologists, at a "nominal charge of ten cents each ... to cover the cost of paper and mailing" (Anon, 1897, 104). It was further noted in the same article, that "the instruments can be made from these drawings by any laboratory possessing a mechanic." The function of the laboratory with regard to these possibilities was important both in the early period of apparatus use and also throughout its development.

In the early stages, when borrowing was most prevalent, apparatus that was not totally appropriate was able to be modified to suit the requirements of Psychology. Additionally, copies of existing apparatus, that were not readily available or overly complicated mechanically, could be synthesised in the laboratory, providing a sometimes crude, but viable substitute. Even at later stages, the possibility of modifying and copying would have still been practiced. Modification in the sense meant here, refers to the structural changes made to apparatus to adapt it physically for the purposes required by Psychology. A second sort of modification, involving the modification of purpose, was inherent not only in structurally modified apparatus, but in all equipment that was used in a different way from that originally intended.

Building new apparatus, or inventing it, was of particular importance for the maintenance and continued development of the New Psychology, as well as the emergence of apparatus possessing an indigenous American character (Popplestone, 1980).

> An imported science in infancy would be served by imported apparatus, but as it grew, matured, and at the same time became indigenous it came to require indigenous instruments (Popplestone, 1980, 162).

Effective invention, referring to the construction of apparatus that did not previously exist (Oxford English Dictionary, 1989; Hatfield, 1948), required the context of the laboratory for success. A clear and dependable distinction between invention and structural modification cannot easily be made in all cases (Jewkes et al, 1969) but a few differences may be noted. Invention involves a new apparatus, although this may be the result of combining parts from existing apparatus. The McDougall Dotter (described in chapter five) for example, makes use of a gramophone mechanism for its motive power. Structural modification, on the other hand, always involves an existing apparatus, with some changes made to it. In my view, the McDougall Dotter qualifies as an invention. It involves part of a gramophone, but this part is used for a different purpose and the resulting nature of the new machine is quite different and unrelated to a record playing device. Additionally, the apparatus as originally invented used a motor which was peculiar to itself. The process of modification, refinement and commercialisation of the apparatus led to the adoption of a gramophone mechanism. Other examples do not allow for such a clear cut distinction, and therefore, the blurred line between invention and modification should be kept in mind.

Apparatus invented specifically for the New Psychology were important to its continued viability and the strengthening of its status as an independent

discipline with its own unique apparatus, and identity. Invented apparatus was also a natural outcome of an active research enterprise. As research was conducted, new research was conceived of, as well as new ways of approaching existing research. The constant use of apparatus would also serve to suggest to its users possible modifications in structure and use, and would result in the production of inventive ideas (Jewkes et al, 1969).

Apparatus may be expected to have had some effect on the research that psychologist's engaged in. Caudle (1983) poses the question of how "apparatus has influenced the course of psychology's development" (47). He offers two possibilities in the form of questions,

> have instruments merely been silent, acquiescent extensions of the psychologists themselves? Or have the instruments in some way played a role in determining the outcomes of laboratory research? (Caudle, 1983, 47).

He suggests that apparatus may affect which problems are investigated if this is a function of apparatus availability, and popularity.

> The variety of apparatus available for purchase may also affect choices of problems, and such availability from manufacturers is to some extent dependent upon continued profitability. [Additionally] once equipment is no longer manufactured, the possibilities for research are reduced and future experimenters wishing to explore additional aspects of older problems may then be faced with the problems of designing and constructing apparatus (Caudle, 1983, 52).

Given the interactive nature of the research process, involving the co-option, modification and invention of apparatus as integral parts of the research endeavour, the significance of apparatus in determining the nature and development of research can not be overlooked. Also, the process was undoubtedly not always one way, with apparatus merely being designed and

constructed to fulfil a research need. There must have been a very interactive process between research ideas and apparatus design and construction, such that the latter had some effect on the former. The machines were not wholly passive. The very acts of designing, constructing and using them suggested further research as well as changes to their design, construction and use.

The involvement of apparatus companies in the development of apparatus was of central importance. Initially, it was German and other European companies that provided specialised Psychology equipment, with American companies offering only general laboratory equipment and apparatus constructed for other disciplines. There was a transitional period, where psychologists and companies became familiar with each others needs. Later, American companies, most notably C.H. Stoelting, produced specifically Psychology apparatus. Ruckmick (1926) noted that American companies first began constructing Psychology apparatus in the early 1890's. At this stage, the arrangements were not along the lines of mass-production. Instead, various companies made apparatus for individual client laboratories, on a small scale, and according to plans or suggestions provided. For example, Elmer Willyoung and Company in 1892 "made up apparatus according to designs furnished by Scripture of Yale." In 1893, the Garden City Model Company "produced instruments from suggestions made by Jastrow of Wisconsin." In the same period, the companies of J.D. Brown and A. Pfeifer, respectively, designed apparatus for Cattell and Witmer and "co-operated with G. Stanley Hall" (Ruckmick, 1926, 583).

C.H. Stoelting demonstrated a similar sort of collaboration with psychologists. It is reported that,

> while Titchener was bringing out the four volumes of his Experimental Psychology, Stoelting spent days and weeks in the Cornell Laboratory, designing, suggesting, and remodelling (Anon, 1943, 450).

Ruckmick (1926) notes also that Stoelting was associated with other "prominent psychologists" such as Jastrow, Sanford, Scripture and Seashore. Whipple (1924) in the first edition preface of his Manual of Mental and Physical Tests noted that,

> at the instigation of Mr C.H. Stoelting, of Chicago, who was undertaken to supply the apparatus and materials prescribed in this volume, I began, in March, 1906, to prepare a small handbook of mental tests" (Whipple, 1924, vii).

The contribution of apparatus companies was related to several points. Already noted, was their involvement with apparatus design. They brought greater uniformity of manufacture and ease of production than was possible with apparatus constructed in the laboratory workshop. Also, a greater number of any particular item could be made and at a price reflecting the advantages of greater production numbers. American companies producing specialist Psychology equipment saved on the cost and time associated with especially importing items, because of their geographical proximity to their market. They were also implicated in the standardisation of Psychology apparatus, and by implication, the standardisation of the research endeavour. Psychologists could increasingly fulfil their apparatus requirements by ordering ready-made, off-the-shelf apparatus, and the apparatus that was available, fashioned to an extent the perceived requirements of psychologists.

It is important to understand better the relative contributions of psychologists, technicians and apparatus companies to the development of apparatus and also towards the research endeavour as a whole. Within the development of Psychology apparatus, psychologists, mechanicians and apparatus companies all had roles in designing and constructing apparatus for Experimental Psychology. These roles changed over time and there was no absolute agreement on what the

roles should be. But it is possible, nevertheless, to get an appreciation of what roles there were and how each contributed to the development of apparatus. A consideration here is given to some aspects of the roles of mechanician's and psychologist's and also the place of each in the development of Psychology's apparatus.

## The Place of Mechanicians in the Laboratory

Not all laboratories had mechanicians, generally only the larger laboratories employed them. Also, the amount of time they were employed varied (e.g., full-time, or part-time) as did the number who were employed. One virtue of having a mechanician available was that savings in the apparatus budget could be made. It was cheaper to make apparatus than to buy it. Some apparatus such as the complicated and sophisticated items (e.g. Hipp Chronoscope) had to be bought, but many other items were amenable to being made locally. This idea of saving money through use of mechanicians was a common theme of papers at the time. Sanford (1893) noted that "if a carpenter and skilled machinist are at command, comparatively few pieces of apparatus will need to be bought outright, and much of the rest will be cheaper made at home" (433). Ruckmick (1926) notes the case where a mechanician earning approximately $2000 p.a. "produces apparatus valued at $5000 for the year" (589) effectively saving the laboratory concerned $3000 from its annual budget for apparatus. The value of mechanicians was clear, but how extensive was their role? In his survey of Experimental Psychology, Ruckmick (1926) provides information regarding mechanicians. Of 60 questionnaires sent to "the most representative institutions of the country" (586) (which would have included largely universities and colleges) 32 replies were received.

$11 590 (or 25%) of the collective laboratory budget of respondents was devoted to mechanicians. The remainder, 75%, was spent on apparatus and test materials. However, some institutions spent nothing on mechanicians (n=7) and for a further number (n=7) no detail was supplied. At least a third of these institutions therefore, reserved some amount of their budget for technical staff. The amounts ranged between $100 and $2 100 with a mean of $1 054. Six were under $1 000 and five were over. Probably somewhat more than a third, while not employing mechanicians directly, had access to technical staff from other departments (the same could also apply for workshop facilities). Also, Ruckmick's figures may hide staff who were involved in a variety of activities, and were not solely technicians. Ruckmick (1926) notes that in this case the person may be

> a general utility man, which situation reminds one of the practice in many European laboratories where the mechanician is at once a skilled expert in apparatus and a general secretary, doing clerical work for the department (Ruckmick, 1926, 589).

Ruckmick's study, while providing detail about mechanicians in the 1920's, does not provide us with direct information about the earlier period of the New Psychology. We can, however, extrapolate some information . Specifically, the importance and extent of technical staff is indicated. From what is known of the earlier period, it seems that there was a progression or development towards providing one's own technical support. Technical staff and facilities were considered an important part of the laboratory and were realised where resources allowed. Limitations such as space and finances were, however, limiting factors on the total integration of technical staff and facilities into the laboratory. Miner (1904) provides detail of the earlier period, from a survey of 34 universities. At Yale, "a teacher of manual training spends half his time during the school year and all of his time during the summer working for the department. A student

also frequently assists" (304). At Columbia, "a skilled instrument builder and a boy assistant are employed the year around" (304). Cornell had a mechanic who was employed for a half day each week.

## Psychologists' Role in Apparatus Construction

Caudle (1983) points out that the invention and modification of apparatus

> required psychologists to develop skills in the design, construction, and repair of instruments, and either to become engineers themselves or to find those who could carry out their instructions (Caudle, 1983, 48).

Opinions varied on what part psychologists were supposed to have in the construction of apparatus. Cattell (1898b) considered technical skills an advantage but that they shouldn't be taught to Psychology students and that if these skills were used, then they would detract from time which could otherwise be spent more profitably on Psychology directly. He refers to students, but the remarks apply equally well to psychologists,

> it is not a necessary function of a psychological laboratory to teach the use of the lathe. It the student can work in metals he has an advantage, though he is also in danger of wasting time (Cattell, 1898b, 658).

Sanford (1893) was more positive toward workshop skills. He suggested that if a technician isn't available then, "the instructor himself, if moderately familiar with the rudiments of wood and metal work, can do a great deal [towards saving money on buying apparatus]" (Sanford, 1893, 433). Further, he points out that it is useful to have some technical knowledge "even for the successful use of boughten apparatus, and every instructor should take pains to acquire it" (Sanford, 1893, 433, emphasis added).

This was a period when laboratories were by and large small, and staff also few. Psychologists were thrown upon their own resources and may have generally had more manual skills than in later periods.

There was little division of labour, and the psychologist was often not only theoretician, teacher and researcher, but also apparatus designer and constructor. This resulted in part from a lack of finances to buy apparatus, inadequate supply of locally available apparatus, the newness of Experimental Psychology, and hence the need for new apparatus for new problems. Because Experimental Psychology was intimately related to its apparatus, an interest and ability in apparatus design and construction on the part of psychologists was quite a natural outcome of the nature of the New Psychology in America.

## The Roles of Psychologists and Mechanicians in Apparatus Invention and Development

Psychologists were involved with both theory and research as well as the design and construction of apparatus. Their involvement with theory and research would suggest to them requirements for apparatus and the psychologist or a technician would then be involved in the design and construction of the apparatus. There were also other possibilities. The technician may have been supplied with a design which was then constructed by him or her. He or she may have made changes to the design and construction information, or he may have only designed and constructed assiduously, following the supplied plans. Whatever possibilities occured, there was always an interactive process between psychologist and technician involving the apparatus. This process affected the final quality of the apparatus produced. It is important to note that technicians

weren't merely apparatus constructing machines. Instead, they played an active part, to a greater or lesser degree, in the quality and nature of apparatus.

Even if technicians were constructing from plans (to take the scenario of least involvement) technical points, such as unfeasible designs, where a design could not be translated into physical form, would have necessitated their active involvement in the design process. Design, and to a lesser extent, construction are both processes as is the interaction between psychologist and technician. This implies that over time, both the involvement and contributions of psychologists and technicians were involved in apparatus development, and the form that apparatus adopted was neither fixed nor rigid. Hence, we need to emphasise that technicians didn't just construct, they were a part of apparatus development. Psychologists did not have a monopoly on design.

Speaking of science in the seventeenth- and eighteenth-centuries, Daumas (1972) points out that

> from the moment that science became experimental, its progress no longer depended on the exercise of the intellectual. The scientists of the seventeenth-century, most of whom were also craftsmen, could not have created their apparatus without the collaboration of the professional craftsmen." (Daumas, 1972, 2).

Daumas considers it important, therefore, in any study of the development of apparatus, to consider both the scholars who used instruments and the constructors who built the instruments. It is clear that , "although the instrument itself might be based on theoretical knowledge, craftsmen succeeded in giving it material form" (Daumas, 1972, 1). Hughes (1988) suggests that there has been a "symbiotic relationship" between inventors and model builders. Despite this relationship, the role of instrument makers in apparatus development has been overlooked by historians.

The extent of technicians' contributions is not well documented in the published literature. Largely the coverage is confined to occasional reference to technicians having made various apparatus. Titchener for example in an article describing new apparatus, gives credit to the Cornell mechanician Mr F.A. Stevens for making the apparatus. He also notes, "I am indebted to Mr Stevens for many improvements of design and for suggestions as regards details of construction" (Titchener, 1904, 61). Scripture (1894) notes that "the employment of a mechanic has furnished the opportunity for the invention of several pieces of apparatus" (69). But, he didn't specify what part or what role the mechanician played in construction and design. Some mention is also made in the literature of the collaboration between Stoelting, Titchener and Whipple, but detailed accounts relating to the process of apparatus development and the roles of psychologists and technicians does not yet exist. Primary sources such as letters and diaries will have to be studied closely to provide the necessary documentation.

One reason why the role of mechanicians has been overlooked by historians of Psychology, may relate to the attitude of the new psychologists themselves to their technical staff, whom they appeared to view merely as workers. Because they were not psychologists, then the technicians were not considered important enough to be written about very much. Pringle (1930), for example, documented the disdain that scientists of the National Academy of Sciences directed toward the inventor Thomas Edison. His election as a member of the Academy was placed in doubt because he was not considered as a scientist.

## Workshops

Cattell (1898b) cautioned that,

> it is bad economy for a university to spend thousands of dollars on buildings and salaries and reduce the efficiency of the laboratory to one-half by not providing a workshop and adequate instruments (Cattell, 1898b, 658).

Scripture (1894) notes that equipping a workshop saved money and meant that the Psychology grant could be stretched to include more equipment than was possible if it was used directly on buying apparatus.

> To have accomplished without a workshop the amount of work actually done in the laboratory would have cost more than the two hundred dollars spent on its equipment: thus at the beginning of the second year [of our laboratory] we are in possession of a well-equipped workshop which has already paid for itself (Scripture, 1894, 69).

While technicians were not universal, and perhaps only the wealthier departments had them, the workshop was more widespread. Miner (1904) in his survey of 34 universities found that "all but seven have made provision for at least a work-bench and tools in the department" (304). A workshop could be very simple and have a minimal collection of tools, and it was this that made it within the reach of most laboratories.

An important function of the workshop, apart from it enabling the construction of invented apparatus, or the construction of copied apparatus, was the repair and maintenance of existing equipment. While every laboratory could not afford to run ambitious programs of construction, all had to at least maintain the apparatus they had in working order. A cheap and quick way to accomplish this was to have a workshop on the premises. Miner (1904) notes that "several of the laboratory directors [in his survey] prefer to have large pieces of apparatus built outside the department, and, therefore, maintain only a small shop for repairs" (304).

Much apparatus was for demonstration purposes and was therefore quiet simple, requiring only simple tools and basic knowledge to construct (see for example Titchener, 1903).

Exhortations that every good laboratory needed a workshop were common. Baldwin (1911) in his Dictionary of Philosophy and Psychology in describing what a Psychology laboratory should constitute, pointed out that "a workshop for wood and metals is very desirable" (605). Sanford (1893) not only suggested that the workshop was one of the special purpose rooms in a laboratory, but that it should be the first room prepared. The money spent on it "would soon save its value in the making and repair of strictly psychological equipment" (433). He suggested that it should also be able to cope with both wood and metal work. Titchener (1900a) puts a workshop in the basement of his ideal laboratory, with an elevator linking it to the rest of the building.

# Chapter Four

## Psychology and the Early Laboratory at Canterbury College

The establishment of the laboratory at Canterbury College is a subject which has not been studied in detail. References to it are invariably cursory and in the context of some other matter. Information concerning the early period of the laboratory is also notoriously contradictory, there being confusion over not only who founded it, but also when it was founded. There is agreement, however, on what took place there. The information available in the History of Psychology literature relating to the laboratory is set out here and makes for a paragraph of contradictions.

Jamieson (1990) says the laboratory was established 1923. Gardner et al (1973) refer to a "Psychological clinic" being established this year. Hunter (1952) and Winterbourn (1953) suggest 1927; and St. George (1987) refers only to "experimental work" having been introduced in 1925. Beeby (1979) suggests that the laboratory began after his appointment to the College staff in 1923. Winterbourn (1940) suggested that psychological testing for guidance purposes began in 1920, although he made no mention of when the laboratory was established.

Boring (1965) has pointed out that "there is a very considerable element of subjectivity" in ascribing the establishment dates of laboratories. This is often done afterward by participants because it "reassures them of their own

originality and establishes their priority" (5). This would help explain the contradictions amongst the participants themselves, but not amongst the secondary writers.

There is equal confusion about who established the laboratory. Jamieson (1990) credits Shelley totally, as does Winterbourn (1940). Winterbourn (1953) suggests it was Shelley whose initiative led to the laboratory, contradicting his earlier statement. Beeby (1979) says that he was appointed, under Shelley, "to establish a laboratory."

The work of the laboratory is described by Gardner et al (1973), who say "educational and vocational testing of children and research in Industrial Psychology" took place there. Other writers agree with these comments.

Why is there such confusion and so little written concerning the early development of the laboratory? It is to these reasons that we now turn. Most historical accounts have been of the type offering a general review of either the entirety of the History of Psychology in New Zealand, or of one subject area, such as Industrial or Clinical Psychology for example. This has led to a paucity of detail of specifics in favour of a large amount of generalities. This is not surprising for a sub-discipline which is, in this country, quite new and feels a necessity to have an overview of the breadth and progression of Psychology's history. Such an approach, which favours a general account, contains, however, a number of inherent problems. The concentration on a wide context of either time, events or subjects results inevitably in the sacrifice of detail. This is not undesirable per se, for too much detail can easily result in a loss of perspective and of the broad historical changes which are one part of the historian's interest. It is quite a different matter however, when our historians never concern themselves with detail. General accounts have their place, but

they must be built on a solid and extensive foundation of basic historical information. Where the general account lacks a solid foundation in basic detail, it can be misleading, although it may preserve in-tact the broadest of historical changes. Another problem with this sort of history, is that it is only one type or approach available to us, but historians have used it to the exclusion of all other methods of history in this country. As a first step towards a History of Psychology it was sufficient, but as the field develops, we need to appreciate that there are alternatives and that we should utilise a variety of approaches if we are to generate accurate, sophisticated and, not least, interesting accounts. A number of writers have made the same suggestion. Cadwallader (1975) for example suggested historians of Psychology include primary sources in their "tool bag" and Boring (1965) advises that "original sources" should be consulted whenever there is confusion about details. (Other useful accounts for the historian of Psychology include, Balance, 1975; Berman, 1967; Boring, 1967; Bringmann, 1975; Brozek, 1975; McPherson, 1975; Popplestone, 1975.)

A not insubstantial quantity of primary historical and other evidence exists which serves to enhance our knowledge of the early development of the laboratory at Canterbury. The primary historical material consists largely of official correspondence between Salmond and Shelley and the College Registry. These have been preserved as part of a policy followed by the College to maintain copies of all such official correspondence. These documents are kept in storage on campus, and are available for consultation upon application. The surprising aspect to these letters is that despite their existence and availability to researchers, they have been hitherto ignored by all of our historians of psychology. Other primary sources, also ignored, include the Canterbury College Annual Report, Canterbury College Calendar and local newspapers. A third type of source, are participants themselves, some of whom, such as Beeby

and later, Dorothy Crowther (at that time Maginness) are still alive and quite amenable to interview.

The development of the laboratory is considered from two perspectives. The first, relates to the laboratory itself, its establishment, development and forms. The second, involves a consideration of the role of Charles Salmond, Professor of Philosophy at the College, in the laboratory's development and in the teaching of Psychology at the College.

## The Early Development of the Laboratory

The earliest time claimed for the establishment of the laboratory is 1920. James Shelley arrived at the College in the middle of this year and took the newly created post of Professor of Education. Salmond had been Professor of Philosophy since 1914, and had taught at the College since 1901. Clarence Beeby was beginning his B.A. degree in 1920.

Shelley wrote in 1927, that "the laboratories for education and psychology were started and have been developed by me since 1920" (Shelley to Registrar 8/12/27). No other evidence directly supports this time for the founding of the laboratory, but that there was a laboratory which began sometime in the early 1920's, and that Shelley was using it for teaching and possibly research purposes, is supported. We know that Shelley was engaged in research more or less directly after his arrival at the College. Beeby (1979) says of Shelley that he "had imported a few intelligence tests immediately after his arrival in 1920, and had been doing some mental testing" (30). Winterbourn (1940) reiterates this point. In March of 1921, Shelley requested permission from the College Board of Governors to "carry out investigation and research in Education at the Girls'

High School", the Principal of which he described as "willing and anxious to offer facilities for the work" ( Shelley to Chairman, Board of Governors 14/3/21). Permission for this work was duly granted, but no details of the research itself are available.

In the same year as this educational research, the Canterbury College Calendar shows that Shelley was offering a course entitled "Experimental Education", which consisted of one lecture per week and the addition of "practical work by arrangement" (Canterbury College Calendar, 1921, 148). The 'practical work' seems likely to have involved work in Shelley's laboratory. In the following year, 1922, the course was changed to "Experimental Pedagogy" and a course text, called Experimental Education (Rusk, 1921) was introduced. Unfortunately, this text has been lost from the University of Canterbury Library.

Its contents would no doubt reveal in detail what sort of activities occured in the laboratory, at least from the date of its introduction in 1922.

Independent confirmation that there was a laboratory in the early 1920's comes from Salmond, who writing near the end of 1922 noted that Shelley had the use of the basement under the Law lecture theatre, which was set aside for purposes of a laboratory (Salmond to Chairman, Board of Governors 15/11/22). Additionally the existence of a grant for "Experimental Education", noted in November 1922, suggests that laboratory research was underway (Salmond to Chairman, Board of Governors 15/11/22). The grant was for £150, of which £32 had been expended by this date. Because the total grant was quite substantial, it is likely that it was in the form of an initial or special allowance. Such a grant was likely to be associated with the constitution of the laboratory, which may have been as early as 1920.

The laboratory at this stage, was operated wholly within the realm of Education. While it may have involved psychological methods and principles in its operation, it did so in a de facto way. This is to say that it had nothing to do with Salmond and the psychology he taught as part of the philosophy curriculum. Salmond wrote near the end of 1922 that "for students taking philosophy ... no provision for [experimental psychology] teaching has been made by Canterbury College" (Salmond to Chairman, Board of Governors 15/11/22). Because psychology was officially taught only as a subject within philosophy, this statement shows that the laboratory was in no way associated with the official psychology. This is an important point, because it helps to contextualise an earlier comment by Salmond which seemingly refutes that Shelley had any laboratory at all. In May of 1921 he wrote,

> I would again make the suggestion already offered to the Board that provision should be made for the teaching of Experimental Psychology at Canterbury College, as has already been done in Wellington and Auckland, and that an Experimental laboratory be equipped for that purpose ( Salmond to Mr Adams, Registry 4/5/21).

On the surface, Salmond seems to refute the idea that there was any laboratory at the time. However, in his statement he refers to Experimental Psychology and a laboratory for teaching that. It is true that no such laboratory existed, but it is necessary to point out that Shelley's laboratory was for Experimental Education and therefore quite different. The distinction may seem somewhat pedantic now, but at the time, there was a clear division between Philosophy (including Psychology) and Education. This division is illustrated later when Salmond's attitude to Psychology and Education is outlined.

What was the nature of the Education laboratory? It had a teaching function since at least the beginning of 1922, when it is known that experimental work

was a compulsory requirement for students enroled in the Diploma of Education. (Salmond and Shelley to Board of Governor's 15/11/22) For this reason, students being taught in the laboratory were older and more senior than undergraduate Education students. This explains another seeming anomaly. Beeby states in answer to the question of what he knew about Shelley's laboratory, that he had no knowledge of any laboratory at that time (Beeby, 1991). As an undergraduate student between 1920 and 1922, Beeby majored in Philosophy, taking only one Education paper, and that was a first year course. In this course he would not have come into contact with the laboratory, and given Salmond's attitude to Education, there was no likelihood that he would have referred to the laboratory in his Philosophy lectures. Other accounts make special mention that Salmond never spoke of the laboratory.

> Salmond never had the faintest interest in the laboratory. He never went into it. He never mentioned it to me. He just treated it as if it didn't exist. I was a lecturer in Logic and I marked papers in Psychology. But we just never, never mentioned the laboratory at all (Beeby, 1991).

Dorothy Crowther makes the same comment, although referring to a time after the period of interest here (Crowther, 1991).

Beeby recalls the room where we believe Shelley's laboratory to have been, as being occupied by a printing press. He mentions no date associated with this, saying only that it "was later on". In 1926 the laboratory moved to new quarters and so it is to this time that Beeby may be referring regarding the use of the room for a press, in which case there is no inconsistency, except that related to Beeby, who in one place says that Shelley did not use the basement and in another place says he did! This is perhaps due to an error of memory or confusion over which room the interviewer was referring to.

Because Shelley was doing testing work, the laboratory may have been used as a convenient place for test administration. More about the laboratory can only be guessed at, although Shelley may have begun his work in the areas of child and adult counselling and evaluation there. Beeby notes that Shelley "was the kind of person who liked to help people with their personal emotional, social problems" and that "people would go to him a lot." Through Shelley's classes on education and psychology at the Workers' Educational Association, people would approach him with all sorts of emotional, social and psychological problems, relating to either themselves or their children. Gradually, developing "quite slowly and quite over a period" of time, this practice became "a kind of clinic" in the the mid to late 1920's and was an additional function of the laboratory. It was quite possible that Shelley was using his laboratory for such purposes, although in a very modest way, as early as 1920.

Although, we don't have much information as to what went on in the laboratory, apart from some teaching and possibly test administration and research, and nothing of its nature is known except that it consisted of one room, we at least know that there was a laboratory.

By knowing what else Shelley was doing in the Psychology field, we can see what may have ben incorporated into his laboratory and its work. Only a few months after his arrival, Shelley was involved with the first Workers Education Association Summer School, held for two weeks over the Christmas holiday period 1920-21. Apart from classes on drama, he offered a lecture each on "Education in Town and Country" and "Education and Psychology" (J.H. Condliffe, WEA to Registrar 4/1/21). In 1921, he was appointed as a tutor (without salary) at the WEA, where he offered classes during the year. Among these were a tutorial class and a study circle, both on the topic of Industrial Psychology. These were new courses, offered for the first time with the arrival

of Shelley (Honorary Secretary, Tutorial Class Committee, WEA to Registrar 17/3/21). What constituted a laboratory for Shelley is unfortunately not known.

## The New Laboratory

In 1923, a new laboratory emerged, of which we know more. It was bigger, better funded and staffed and was officially designated by the College as a laboratory for "Experimental Psychology" (Registrar to Shelley, Salmond 27/2/23) so was in a sense a new laboratory, rather than a continuation and expansion of Shelley's Educational laboratory. This distinction was however merely official and administrative. In practical terms, it was run by Shelley and a new assistant, Beeby, and represented a continued expansion of Shelley's initial work and enthusiasm as embodied in his earlier laboratory. Additionally, Shelley's basement room was incorporated into the new laboratory. Salmond and Shelley's report outlining the requirements for the new laboratory, asks for two rooms and a basement. The two rooms were yet to be granted, but the basement, it was noted, was already in use, "Professor Shelley has already the use of the basement beneath the Law lecture room" (Salmond and Shelley to Board of Governor's 15/11/22). This makes plain, that the new laboratory was at most basic, an extension of the existing laboratory.

According to the record, the new laboratory arose because of teaching requirements. The College Committee at its meeting of October 1922, discussed the requirements for teaching Experimental Psychology. This subject was an optional part of the Philosophy curriculum, which had hitherto never been taught

at Canterbury (Salmond & Shelley to Board of Governors 15/11/22) so it was only a paper option for Canterbury students. On the annual examination papers, which were in this case shared by all four Colleges of the University of New Zealand, some questions related to experimental psychology. Where students had the opportunity of working in an experimental psychology laboratory (as in Hunter's laboratory at Victoria College) they were allowed to attempt this part of the examination. In this way, an experimental psychology laboratory at Canterbury College would allow Canterbury students this option also. The College Committee asked Salmond and Shelley to prepare a report on the establishment of a "suitable laboratory" which would "meet the requirements for the syllabus in Experimental Psychology" (Registrar to Salmond 26/10/22). The implication was that Shelley's laboratory as it stood, was not suitable. Why the College Committee should have acted at this particular time, is not explained sufficiently by the desire to allow Philosophy students the option of attempting the experimental psychology questions on their exam papers. The College could have done this any time after the option was first initiated. In their report for the College Committee, (Salmond and Shelley to Board of Governor's 15/11/22) Salmond and Shelley suggest three further reasons. Firstly, experimental work was compulsory for Diploma of Education students. Secondly, it was considered desirable "for students taking psychology to assist their Education course." Thirdly, "a proposal is before the Board of Studies to make Psychology by itself a subject for the B.Sc. degree. In this course Experimental Psychology would be compulsory." I believe it was the collective force of all of these reasons, rather than any of them singly, that prompted the Council's action in calling for a report on a laboratory. Other factors were also involved, for example, Salmond's earlier suggestions that there should be an experimental psychology laboratory at Canterbury. These suggestions were made on at least two separate occasions, the second being in May 1921, as already noted.

Another factor was that Shelley was already operating a laboratory of sorts, which demonstrated that the necessary expertise was available to organise and run a larger laboratory.

The report that Salmond and Shelley were asked to prepare, is dated about three weeks after the request for a report was made. This would have given the two men time to discuss their requirements and to reach mutual agreement. We must assume that they did work on it collaboratively. It was Salmond who was formally asked to prepare the report, but the request makes clear that the report should be the product of a joint effort. "I shall be glad" wrote the Registrar, "if you will confer with Professor Shelley on this subject" (Registrar to Salmond 26/10/22).

The report itself outlines the requirements of the laboratory, assuming it was to provide for "a minimum of students, say twenty." It was proposed to continue using Shelley's basement laboratory, in addition to "at least two fair-sized rooms." Beeby suggests that in the new laboratory, the basement was used only as a workshop for apparatus construction (Beeby, 1991). It was pointed out that there were two suitable and vacant rooms in the Physics Department, which Farr, the Physics Professor, was willing to make available. There was some optimism about the possibility of future expansion, even at this stage. "As the work extends, more rooms will be required." In support of this contention, it was noted that Victoria College had 70 students and therefore a correspondingly greater number of rooms, at seven.

With the object of saving money, the "use of the Physics workshop and the services of a skilled mechanic for the making of apparatus" were additionally requested. The mechanic was attached to the science laboratories (Registrar to Shelley 27/2/23). Another saving was hoped to be made by the borrowing of

Physics apparatus. Professor Farr, seemingly ever helpful, had already "promised the use for the time being of certain apparatus that is common to Physics and Experimental Psychology." Presumably, in this case, the borrowing of apparatus was a temporary measure, until some apparatus could be constructed in the workshop and other equipment and materials could be ordered from overseas. Such imported apparatus required money however, as did even the construction of simple pieces, so an initial grant of £200 was requested for such expense. The remaining £118 of the money given to Experimental Education was also to be devoted to the new laboratory, further suggesting that it was little more in practical terms than an extension of Shelley's laboratory. In addition, to meet the costs of the laboratory on a continuing basis, an "annual allowance of at least £50" was requested.

A final requirement for the laboratory, was an assistant who would take "full charge, under the supervision of Professors Salmond and Shelley, of the work in Experimental Psychology." This was to involve, "laboratory work covering 50 hours per session on the part of each student [and] at least one hours lecturing per week." The assistantship did not require an additional staff member however. It was planned that the new position would merely replace that of the "current assistant to the Chair of Philosophy", involving all of his duties, in addition to those associated with the laboratory. The position would however, be made full-time, whereas Salmond's current assistant was employed on a part-time basis. The extra work that this arrangement entailed required that the position should become full-time. It was suggested that a Canterbury philosophy graduate would be suitable for the position, and that he or she could be trained in experimental psychology work conjointly with his or her employment. Given that there were not very many philosophy graduates and even fewer with an inclination toward experimental psychology and further, that

Beeby was a well performing student who would be freshly graduated the following year, it may have been that at the time of preparing the report Salmond and Shelley were already considering him as the "satisfactory man" that was required. The salary proposed was £350, which although a large amount, was considered necessary "as it would be difficult to get a suitable man."

In February of the following year, the Registrar informed Salmond and Shelley that all of their requirements as outlined above, except for the matter of the assistant and his salary, had been granted (Registrar to Shelley, Salmond 27/2/23). The assistants position was to be designated "as a temporary arrangement for the current year" and it had been decided to offer only £200 per annum. Beeby's position, according to the Salmond and Shelley report, was to be assistant to the Professor of Philosophy, although he was to take guidance from both professors on matters pertaining to experimental psychology. The Registrar's letter however, describes Beeby as "assistant to the Professors of Philosophy and Education" and that his hours of work should "be mutually arranged" by them. This all serves to suggest that Beeby's position was somewhat anomalous and suspended somewhere in between the Philosophy and Education departments.

During the first year of the new laboratory, Beeby received training from Shelley in experimental work (Salmond to Chairman, Board of Governors 20/10/23). The form and content of this training is unknown. At the same time Beeby was lecturing in philosophy as Salmond's assistant and also writing his M.A. thesis (Beeby, 1923) which he finished that year. During the year £75-8-10 was spent on apparatus by Shelley (Canterbury College Annual Report, 1924). More is known about the further training Beeby underwent at Hunters Victoria College laboratory during the summer of 1923-24.

Because this was the only other Psychology laboratory in the country, it seems logical that observing its methods and operation could be of great use in learning more about experimental psychology. Whether Beeby's sojourn there was by invitation or at his own or Shelley's initiative is not known, but Salmond points out that Beeby made the journey "to finish at his own expense his preparation in Experimental Psychology" (Salmond to Chairman, Board of Governors 20/10/23). Beeby says of his time at Hunter's laboratory,

> I came up and spent a long vacation with Thommy Hunter and he was extraordinary. He gave up his long vacation, I realised later. He introduced me to it all, gave me copies of all the material - I had all the apparatus. [He] had a series of very good sheets, with instruction sheets, cardboard sheets - for each experiment you see. So I got copies of all of these and I worked through those for myself as far as I could, alone, and I had time in the library (Beeby, 1991)

Beeby returned to Canterbury not only with the experience of the apparatus at Hunter's laboratory and working through experiments with these, but also tips from Hunter as well as the copies of class experiments he mentions.

Before Beeby's arrival, Hunter wrote to Titchener offering his rather pessimistic view of the Canterbury laboratory, and the ensuing visit by Beeby. He commented tersely,

> You will realise the value that it is proposed to place on scientific training when I tell you that all the preliminary work to be done by the instructor will be that obtained in working (largely by himself) in our laboratory during the vacation when there are no students here (Hunter to Titchener 27/11/23 (in) Brown & Fuchs, 1969).

This comment was written before Beeby's arrival and it is likely that it is a reflection of Hunters negative outlook on the Canterbury laboratory and of Salmond and Shelley. In the same letter he attacked the new laboratory because

"it will be under the professor of education and I am afraid will be 'applied' in the worst sense." Of Salmond he asserted that he "is strongly opposed to experimental psychology and has done his best to prevent the university from recognising the experimental work done here." It seems likely that, after devoting his whole summer in the service of assisting with Beeby's training, Hunter's attitude may, as a result, have become resultingly more positive, if only because he would then have had some influence in the future operation of the new Canterbury laboratory.

Among Shelley's lectures given to the WEA for 1923, was "Social Psychology" (Press 19/3/23). A report of his first lecture in this series notes that he "introduced the subject with an analysis of what is termed the 'behaviourist' point of view" (Press 22/3/23). He also lectured again on industrial psychology. A description is provided by one of his colleagues, the Secretary of the Christchurch WEA.

> In 1923 he formed a class mainly of trade union secretaries in the Trades Hall and brought down his measuring apparatus, particularly for measuring reaction time, and various measurements of that kind, and demonstrated to students ... the value of understanding psychology in industry, the measuring of fatigue and the time of recovery from fatigue, and those lectures were really of great benefit to the trade union secretaries and widened their view of the relationship of the workers to their employment and how conditions might be improved (G. Manning, Transcript of Sir James Shelley: A Radio Portrait, undated).

Beeby was reappointed for 1924 as Salmond's assistant and also to work in the laboratory. His position was still described as temporary, but his salary increased to £250 per annum (Acting-Registrar to Salmond 3/11/23). Shelley taught Social Psychology again at the WEA (Press 27/5/24).

Curiously, although teaching was occuring in the laboratory on some basis and possibly as early as 1920, there are a number of discrepancies in the sources relating to this matter. The earliest date that a fee was set for experimental psychology was 1924, when the amount of £1-1-0 was agreed upon (Press 29/4/24). It is probable however that teaching prior to this year was on a more informal basis and therefore had required or attracted no fee. Another discrepancy is to be found in the Canterbury College Annual Report for the following year. It is explicitly stated that 1925 was the first time that experimental psychology had been offered. Also for the first time, numbers of students taking this subject were listed. There was a total of 15 students (three additional students did not complete the course) 11 of whom were men (Canterbury College Annual Report 1926). The most likely explanation is that 1925 represented the first year that experimental psychology as a formal subject in its own right was offered. Previously, it was offered, along with experimental education, in the form of practical work as part of other courses, such as the Diploma of Education, and was therefore disguised in the statistics of other courses.

In February of 1924, Beeby obtained a quote and permission to have built a Rimu desk with leather top, in addition to two small tables. The desk was presumably for his use, and the tables for work in the laboratory (O.S. Pennicuick & Co. to Beeby 20/2/24; Registrar to O.S. Pennicuick & Co. 22/2/24). Other additions to the laboratory were carpet ("sea-grass matting") for one of the rooms and the provision of heating. Shelley noted that there was "no heating arrangement for the two rooms used as psychological laboratories." He requested therefore, an electric heater and gas stove for each room (Shelley to Registrar 23/6/24).

A month earlier, the Rector, Dr. Chilton, was reported in the Press commenting on the College heating. He described the need throughout the entire College for a better heating system as urgent "in view of the approach of winter." The lecture rooms were "heated either by single open fires, or in some cases by gas fires or electric radiators, but in the rooms which get no sun during the day these are not sufficient to make the room at all comfortable" (Press 27/5/24).

Although there is no listing for apparatus expenditure in the Canterbury College Annual Report for 1924, we know that Shelley was granted permission to expend £21-1-8 on a gramophone, which he wanted to use "for the purpose of sound experiments" (Shelley to Registrar 23/6/24; Registrar to Shelley 11/7/24).

With the removal of the Boys High School to Riccarton being planned, and vacant space becoming available for the College, various disciplines were asked to outline their requirements for rooms. The laboratory and education were not moved until 1926, but they made submissions in 1924. The laboratory was to be relocated because its current quarters were only temporary. Salmond requested "four rooms, one large and three small" (Salmond to Rector 17/7/24). Education was also to be moved, and Shelley requested "a private room for myself and one for my assistant [and] a large lecture room" (Shelley to Rector 29/7/24).

The expenditure on apparatus for 1925 was £79-13-2, of which £22-10 was expended on a weighing machine for "Anthropometric work in Psychology of Education." Shelley argued that the scales were needed because "it is a necessary part of the training for the Diploma of Education that all ordinary

measurements should be taken. Much of the apparatus is being made in the workshop, but of course a weighing machine is a specialists' job" (Shelley to Registrar 12/3/25). A picture of Anthropometric scales, possibly similar to those in use by Shelley, is illustrated in figure three. Some insight into what Anthropometric research involved is provided by Baldwin (1911). He describes Anthropometric work as involving "measurements of height, weight, diameter of chest, etc, ... made by direct measurements" (Baldwin, 1911, 615). Instruments for making such direct measurements included Scales (weight), Craniometer (dimensions of the head), Puppillometer (diameter of the pupil of the eye), Spirometer (lung capacity) and the Opthalmometer (curvature of the cornea).

Shelley and later Beeby were involved in the production of apparatus for the laboratory. Apart from that constructed for the Anthropometric work mentioned above, it seems that a wide variety of apparatus was constructed. Two such pieces still survive. One is a hand operated colour-mixer (of which a number were made) and the other is a shock-plate (see chapter five for details). The colour-mixer, constructed largely from Mechano parts, was presumably in some way associated with Shelley's personal theory of colour vision. Beeby notes,

> I remember once when he worked out a theory of colour vision, which are very difficult and tricky things - [but] there is a satisfactory one; his was the best I ever heard of. But nobody will ever hear of it again because he never wrote it [down] (Beeby, 1991).

Beeby reports that Shelley and he used the workshop to make apparatus on Friday afternoons. Shelley taught him to use the workshop lathe and was "extraordinarily good with his hands [making] some really quite elaborate stuff" (Beeby, 1991). Shelley was accomplished equally with metal and wood.

Beeby was better with the latter. Beeby offers some description of the sort of equipment made by the two men together.

> Oh well, we began first of all with the senses, and reaction-time, learning skills, the various skills, using plungers and all that sort of stuff .... And he even made a psycho-galvanic reflex - the first one in New Zealand - which was a showpiece (Beeby, 1991)

Presumably some work in the laboratory was being done with the Psychogalvanic apparatus. In June of 1925, Beeby gave a lecture concerned with "The Measurement of Emotions" to the local Scientific Society. This provides a revealing description of the machine Shelley developed. What was undoubtedly one part of the device, a resistance box (see chapter five) which consists of a number of dials with pointers and scales, as mentioned by Beeby, still survives.

> An exact scientific method of measuring the human emotions was demonstrated by Mr C.Beeby. [He] showed how [human] emotions could be measured by an instrument which depended for its functioning on the relation of electrical resistance to emotional resistance and why one could be taken as equivalent to the other. On the instrument the different degrees of emotionalism shown by different tests were indicated by means of a pointer on a graduated scale. The different effects of deep breathing, coughing and the presence of something hurtful were demonstrated. Several theories had been put forth as to why the emotions could be so measured, but nothing definite was known at present. A new experiment illustrating the effect of emotions on electric resistance was also tried (Press 19/6/25).

1925 is the first year we have any indication of the operation of the laboratory. Salmond notes that with 18 students (3 later withdrew) 10 hours of demonstrating by Beeby was required. However, as "only a few students can be taken at one time" the number of teaching hours was a function of the number of students. This suggests that the work involved Beeby working with only two

or three students at a time demonstrating experiments and having them work through experiments on each other. Apart from the time occupied by teaching, there were "a good many hours" spent in preparation work (Salmond to Registrar April 1925).

The opportunity to shop for more apparatus first hand in England arose in 1925 with Beeby's departure to England. He was to be away for two years during which time he planned to work on a doctorate. Salmond and Shelley seized the chance of having him purchase apparatus for the laboratory during his stay. In a joint report on the matter, they wrote,

> It is extremely difficult in New Zealand - away from the great psychological laboratories of the world - to order apparatus to the best advantage, we therefore propose that the Board should sanction the purchase in England by Mr Beeby of such apparatus as he finds is needed to equip the Psychological Laboratory on an up-to-date and adequate scale - this will in the end be a substantial saving to the College (Salmond & Shelley to Chairman, Board of Governors 16/4/25).

Beeby was given the authority to buy up to the value of £200 of apparatus. He was given in addition a payment of £100 over two years for the provision of this service and as an acknowledgment by the College that his experience in England would "indirectly be to the advantage of the College" upon his return and reappointment (Beeby to Chairman, Board of Governors 16/4/25; Registrar to Beeby 30/4/25). Beeby sent "a batch of apparatus" to the College in April 1927, but unfortunately the invoice describing this could not be located (Beeby to Registrar 13/4/27). While he was away, Beeby's work was taken over by R.B. Wells, an arts graduate who had taken experimental psychology and education only in 1925. Wells was selected by Beeby "as the man best fitted to carry on

the work of the Psychological Laboratory" (Shelley to Registrar, undated, probably November 1925).

This account of the laboratory at Canterbury College incorporates all locatable primary source material held at the University of Canterbury. The sources are sparse in many respects, not least relating to the running and practices of the laboratory, and many questions raised can only be guessed at. However, the account provides a clearer view than all previous attempts, which have served largely to confuse the standing and development of the laboratory.

## Salmond's Role

Whereas confusion was the state of secondary source accounts of the laboratory, all seem agreed on their interpretation of Salmond's contribution to the laboratory. He has been presented as making an exclusively negative contribution. He is pictured as strongly opposed to the establishment of laboratory Psychology and antagonistic generally towards Experimental Psychology. In other words, he is pictured as an obstacle which the new psychologists (in this context, Hunter, Shelley and Beeby) had to climb over or otherwise negotiate if they wished to develop their fledgling attempts at establishing the New Psychology in New Zealand (Hunter, 1923 in Brown & Fuchs, 1971; Beeby, 1979; Gardner et al, 1973; St. George, 1990).

Given the inaccuracy of the accounts about even relatively simple matters such as dates, it is important to consider the primary sources in order to gain a balanced understanding of Salmond's role in the development of the laboratory.

Salmond first lectured in Philosophy at Canterbury College in 1901. The position was initially part-time, but became permanent in 1906, when he was

designated as lecturer in Philosophy and assistant to the Professor of Classics (Press 7/12/34). 1914 witnessed the establishment of a chair in Mental Science at the College, with Salmond as the recipient. Although he had been teaching what was variously called philosophy and mental science since 1901 (Canterbury College Calendar, 1903) the establishment of the Chair was an acknowledgment of the importance of both the subject itself and his work in it (Canterbury College Annual Report, 1915). A report in the Press provides some more specific details as to why the Chair was established.

> The educational value of this subject was becoming more and more important [and] the number of students had been growing over the years. The work done was of a very high character, and equal to that done by the professors with the largest number of students in other subjects. A large number of students were sitting for honours, so that a good deal of work was being done (Press 31/3/14).

Dr Hight of the College, suggested that the establishment of the Chair "'was really a tribute to the excellence of Professor Salmond's work'" (Press 7/10/34).

The content of Salmond's teaching involved a substantial component of psychology. Information available for "mental science" between 1903-7 provides the general subjects taught. For the B.A., work involved Logic, deductive and inductive, Psychology, and Ethics. The text for the Psychology component was Sully's Outlines of Psychology (Sully, 1906) first published in 1884. For honours, these subjects were taught with the addition of the History of Philosophy. The text for Psychology at this level became Hoeffding's Psychology (Hoeffding, 1891/1912).

In 1914, four papers were taught. The two at undergraduate level were Logic and Psychology. The honours papers were Logic, Psychology and Ethics and the History of Psychology. Figures available for the years 1911-15 show that

Psychology and the paper which included a component of it, were the most popular amongst students , as indicated by enrolment numbers. In 1915, 43 students were reading Pass Psychology, almost twice as many as were attending the equivalent level Logic lectures (Canterbury College Annual Report, 1916).

Psychology was assigned considerable importance in the undergraduate course. For example, in 1921 when three general papers were offered, Psychology, Logic and Ethics, it was only Psychology that was offered every year. The other two were offered only on alternate years. Detailed data for the same year shows that of 12 hours Salmond devoted to teaching each week, fully one third of this time was given to psychology. Pass Psychology, took three hours, the most teaching hours of any single paper. Additionally, psychology, both at undergraduate and graduate levels, was the most popular subject amongst students (Salmond to Department Chairmen, Board of Governors 18/6/21).

Beeby, who was enroled for Psychology papers in the early 1920's provides some account of the content of Salmond's Psychology, albeit rather negative,

> [Psychology] was just part of Philosophy and it was treated as part of Philosophy and the only methodology was, the only methodology, was introspection. So you just sat down and said what was going on in your own head. So Psychology very largely, Psychology One, consisted very largely of, oh they did borrow something from colour vision and that sort of thing, and a bit of elementary physiology and anatomy - very elementary - and so it was sensation, perception, memory, learning (Beeby, 1991, original emphasis).

Apart from the texts already mentioned, Beeby notes that McDougall's An Introduction to Social Psychology (McDougall, 1916) was also in use. A search of the Canterbury College Calendar for the years between 1919 and 1925, revealed three additional texts, which were used in Psychology. Stout (1901) was a long-used text, but in 1924, two new works were added. One was a

more recent book by Stout (1908) and the other an effort by Woodworth (1922), entitled Psychology: The Study of Mental Life.

From the above information, it is plain that Salmond was not only teaching psychology to both junior and senior students, but also that he devoted a fair amount of his time to this, and had been doing so for almost twenty years before Shelley arrived at the College in 1920. It seems hardly creditable that Salmond would teach psychology for such a period of time, if he was contemptuous of it or did not believe in its intrinsic merit as a field of study. But what specifically do we know of his attitude to psychology? He made reference to psychology in his letters on a number of occasions. These letters were almost entirely concerned with Salmond's concern with being provided with an assistant to help with his marking and teaching load. However, the excerpts relating to psychology are sufficient to reveal something of his attitude.

In the early 1920's, Salmond recognised that the subject matter of psychology was growing to such an extent, that any adequate treatment of it required specialisation in the subject. While at Canterbury College Psychology came under the province of Philosophy , the amount and diversity of material Salmond had to be familiar with and to teach was too much for one person to cope with. For these reasons, he suggested that the teaching of Psychology should be removed from Philosophy. The suggestion was not, however, merely a response to being over worked and under assisted. He expected extra help in Philosophy, and to be sure, the removal of Psychology would help to lighten the load. It would also mean that he could perform his work to a higher standard. However, he made it clear that any division should result in an increase in the status of Psychology by allocating to it a Chair and Professor. It was not his intention to merely off-load Psychology and abandon it. If division

were to take place, he wanted Psychology to be given due recognition. He wrote,

> The time is rapidly coming when the subject of Philosophy must be divided in the University, and two chairs established in it in our College. Psychology now ranks as one of the special sciences, and any adequate treatment of it in all its departments demands a separate chair, as indeed the University of Sydney has lately recognised. Psychology is now seen to be the foundation on which all the social sciences rest, and these social sciences, as a recent writer has said, are to occupy in the twentieth-century the place that the physical sciences occupied in the nineteenth (Salmond to Mr Adams, Registry 1/5/21).

He reiterated this point two years later (Salmond to Chairman, Board of Governors 20/10/23) and again in 1927, where he followed the same argument but from a different perspective,

> I do not think the Board sufficiently recognises how burdened with subjects the department of Philosophy is. Psychology alone is probably wider in extent than Economics, and is itself enough for one man's shoulders. Dr McDougall, one of its leading modern exponents, has recently said that a single lifetime seems hardly sufficient to achieve something like general competence in the field of Psychology (Salmond to Chairman, Board of Governors 21/7/27).

These statements help to interpret a further comment by Salmond which primae facie appears to be critical of Experimental Psychology. Writing for the Australasian Journal of Psychology and Philosophy, he asked,

> As long as Psychology remains in our University curricula merely as a sub-branch of Philosophy, is it right that Experimental Philosophy should occupy much of the students', not to speak of the Professors' time? (Salmond, 1923).

Out of context, this question gives the impression that Salmond thought that less time should be given to Experimental Psychology and that time devoted to the

subject in general was a waste of time and certainly a distraction from the other parts of Philosophy. In a wider context however, it becomes clear that Salmond considered that Experimental Psychology was important enough to deserve the heightened status of becoming a part of an independent branch of study under the general heading of Psychology. He thought it ridiculous that Psychology, in its ever expanding form, should be compromised by a continuance of its traditional categorisation as "merely a sub-branch of Philosophy".

Salmond made no secret that his own personal interest lay with Philosophy. He was above all else, a Philosopher. The New Psychology, in all its facets, was becoming a discipline unto itself and quite apart from Philosophy. I think that Salmond had little or no interest in this new area. When Beeby was appointed as Salmond's assistant, Salmond left the duties associated with the running of the laboratory with his assistant. There is no evidence suggesting he took any active role in the work of the laboratory.

A number of comments contained in Salmond's letters demonstrate that he considered the work of Philosophy to be of greater worth and importance and also more difficult than Psychology. While Beeby was working for his doctorate in England between 1925-27, his duties at the College were divided between two new assistants. Salmond compared the salaries of his assistant (Mr Field) who was teaching Philosophy and the other (Mr Wells) who was assisting Shelley with the work of the laboratory. Salmond complained that Mr Field was paid £25 less than Mr Wells, which he considered to be "unjust, as Mr Field has the more difficult work, involving more knowledge and experience" (Salmond to Chairman, Board of Governors 19/8/26). Later, when

outlining the duties he would like Beeby to have on his return, which were to be divided between Philosophy and Experimental Psychology, Salmond described the former of these duties as "the heavier and more important part of his work" (Salmond to Chairman, Board of Governors 21/7/27).

It should be noted however, that in Salmond's eyes, Philosophy was ranked not just above Psychology, but also above all other subjects. It was not only Psychology that he viewed as of less importance. "Philosophy is a fundamental and difficult subject, and a teacher more than any other teacher in the University needs time for preparation, reading and thought" (Salmond to Mr Adams, Registry 4/5/21).

None of these remarks indicate that Salmond was anti-Experimental Psychology or was of the opinion that it should be suppressed, as has been suggested by other sources such as Hunter and Beeby. They show instead Salmond's deep interest with Philosophy and his concern that Psychology should be given its rightful recognition and status as an independent discipline. Other actions of his were unequivocal demonstrations of his support for Experimental Psychology. As was mentioned earlier, he suggested that the College should have its own laboratory for Experimental Psychology and he worked together with Shelley on the preparation of a report which resulted in the realisation of such a laboratory.

Finally, some consideration must be given to Salmond's academic character and abilities, because these have been referred to by others in a way which presents a negative image of Salmond. I refer particularly to the comments of Beeby on Salmond's teaching of Psychology. Describing his teaching as being "entirely verbal" which is to say that it involved the lecture method, Beeby says,

> My Professor of Philosophy dictated notes slowly to a class of 60 at stage one. There were no questions, there was no discussion. Stage

> two, he dictated to a class of about 15 - no discussion, nothing - he just dictated notes solidly. If anybody asked him a question he'd say, 'Well I'm sorry, but I'm a bit behind in lecturing this year, I can't discuss that just now.' Stage three, there were two, I was one, and he lectured notes, dictated lectures for four hours a week, solidly. When it came to Honours, I was his only student and there was a great change. Instead of lecturing in the lecture room, he moved a table into his room. I sat by his desk and he dictated notes at me for five hours a week, without - I asked questions twice, two questions I remember, and he said, "I'm very sorry, I'm behind in my lecturing." Poor devil didn't know the answers of course. So that was Psychology. That's all we had to begin with. I mean, there was, think of the names coming on the horizon, there was Freud for example. Never, never mentioned, Nothing, nothing that was being done at all, was ever mentioned (Beeby, 1991).

Beeby makes two main points. First, that because Salmond taught Psychology without the use of a laboratory or laboratory exercises his teaching was deficient. Second, that Salmond didn't know the area of Psychology well and couldn't answer questions based on what he was lecturing. In other words, that as far as teaching Psychology, he was incompetent. There is no way of directly checking the validity of Beeby's recollection. However, a collection of comments referring in a general way to Salmond's character and abilities exists, and this provides a contrary image. These comments have been ignored by writers in this area. Some of the comments were made at the time of Salmond's retirement, while others occurred after his death. All were taken from the Press December 7 1934.

Former student, Archdeacon L.G. Whitehead said,

> 'As a teacher he was a master of his subject, and to his students he gave the most careful and competent teaching that raw beginners could hope for ... no one could have asked for a kinder or more competent instructor.'

Dr Hight, of the College, added,

> 'His work generally was marked by extreme thoroughness and single-minded devotion to duty. He always held the confidence of his students who felt that he was master in the field which he chose to develop most in his lectures.'

He also noted that "'the excellence of his work was well known throughout the Dominion and held in high regard by his colleagues.'"

Apart from pioneering Philosophy at the College and increasing the amount of work done and the numbers of students enroling in his subject, Salmond was also held to be largely responsible for increasing the interest among students in Psychology. These feats would seem unlikely if he lectured in as boring a manner as Beeby suggested.

Beeby himself said of Salmond, in the Press report, that "he had the highest admiration for the clarity of the professor's thought and for the precision of his teaching methods."

Salmond published a number of articles and book reviews of an academic nature in the Australasian Journal of Psychology & Philosophy (Salmond, 1925, 1927, 1928, 1929, 1930). He was a Council member of the Australasian Association of Psychology and Philosophy (AAPP), which began the above journal in 1923, and was elected as the foundation President of the Canterbury Branch of the AAPP, in 1928. Interestingly, at the same time as his election, Shelley was elected as Vice-President and Beeby as a Committee member. In addition to his university lectures, he gave talks to members of the WEA, such as for example, his addresses at the WEA 1920-21 Summer School, entitled, "The Root Forces of Human Nature" and "The Making of Personality".

The information offered here, hitherto ignored, suggests Salmond was a scholar, an active participant in the academic community and interested in the education of the general public. This does not present a picture of an academic incompetent.

In summary, Salmond was devoted to Philosophy. This should not be viewed as a crime, but rather as an admirable quality. He was concerned that with the expansion of Psychology, he could not cover the ground required for adequate teaching. Salmond viewed the separation of Philosophy and Psychology as a solution which would benefit both his teaching of Philosophy, and also the provision of specialist teaching in Psychology. Students would receive better training with such a division and also Psychology would receive the increased status which he felt it deserved.

The negative appraisal that Salmond has received from the secondary sources, is a function of their being supporters of the traditional paradigm, that the much vaunted Scientific Psychology began by separating itself from the shackles of Philosophy. Part of this view is that any Philosopher is regarded as an impediment to the progress of Psychology at that time, no matter what their opinions, attitudes or actions were. As a result, they have not only been vilified and scapegoated, but most commonly, simply ignored. Any positive contributions, or even anything positive about them, have been, in effect, written out of history.

Samelson (1974) describes such a presentation as part of the origin myths of Psychology. Origin myths involve the writing of history, not as a "critical examination of the past", but instead for the purposes of presenting a particular view. By its nature, this involves the selective or otherwise unfair use of historical sources, or in some cases their non-use. The following excerpt from

Samelson (1974) helps us to understand why Salmond has been negatively presented and alternatively ignored and why we must adopt a critical examination of the historical accounts of New Zealand Psychology that have been written to date.

> ... psychology's origin myths celebrate the heroes who slew the dragon of metaphysics and rescued the fair maiden of empirical science, the lawgivers who proclaimed the end of ideology. But as we are learning slowly, to reject metaphysics does not guarantee the non-metaphysical nature of one's position; to proclaim the end of ideology may itself be an ideological move (Samelson, 1974, 228).

# Chapter Five

## A Project in the Location, Identification and Preservation of Early Psychology Apparatus

The research involved in the previous chapter, concerning the development of the laboratory at Canterbury College, led naturally to questions relating to the apparatus of this laboratory. Given that written material still existed, was it possible that some of the apparatus used in the laboratory had also survived the passage of years? Interestingly, the process which brought me to a consideration of the laboratorys' apparatus, was the exact opposite of that Harper (1949) experienced. His historical account of the laboratory of William James arose from attempts to classify some of his department's early psychology apparatus.

> In the process of cataloguing them it was discovered that in 1893 ... the Harvard Laboratory owned several hundred dollars worth of equipment which did not appear as items among the Laboratory's then recent expenditure. These pieces seem[ed] to indicate the existence of a laboratory for psychological research at Harvard prior to the founding of the formal laboratory (Harper, 1949, 169).

So began a search for historical material that would clarify the conflicting information (see also Sokal, 1972).

The hope of finding apparatus used in the College laboratory offered the possibility of gaining a greater insight into the activities of this laboratory. The letter sources offered a partial answer, with the location of a series of orders for

equipment and tests from companies making these. Additionally, newspaper reports provided additional detail. However, locating surviving apparatus, which is in effect, three-dimensional historical material, would provide still further information and would also allow first-hand experience of the equipment (Sokal et al, 1976). A further benefit was that, because the apparatus was physically present, and relatively mysterious as regarding names and functions, it acted as a stimulus to search early sources of information about experimental psychology for explanatory material. The use of both written material and the apparatus itself, resulted in a better understanding of the apparatus than would have resulted from merely consulting written sources.

The historical utility of old apparatus does not end, however, with the points raised above. As Sokal et al (1975) suggest,

> like any good historical source, the only limits on what can be learned from psychological instruments of the past are those of the imagination of the psychologist or historian working with them (Sokal et al, 1975, 286).

A further discussion of the historical utility of apparatus is provided by Sokal et al (1976).

Because the apparatus is a form of primary historical material, it is important to preserve it, thereby making it available for study not only by current historians, but also historians of the future, who may think of ways of studying it that have not occured to us, or may simply adopt different interpretations of it. In either case, the availability of the apparatus itself would be invaluable to future study and research.

"To utilize valuable laboratory psychology instruments as resources", However, as Sokal et al (1975) point out, "they must first be located" (284). Once located, they must be preserved, because by so doing, they are made available for study.

One means of preservation is to publicly exhibit the apparatus in a display case, either in a local museum or in the Psychology Department to which the apparatus belongs. Such preservation has the added public relations advantage of attracting attention to the history of psychology, and perhaps even of encouraging research in the area.

Given the importance of locating, preserving and documenting early psychology apparatus for increasing our understanding of psychology's history generally, and the specific relevance of the apparatus for increasing knowledge of the laboratory at Canterbury College, a project was undertaken to locate, preserve and document apparatus used in the laboratory. A brief description of what this involved, is followed by a description of each item with the aid of written sources. The order of presentation of the items follows Baldwin's (1911) categorisation of apparatus. He divided apparatus into three broad groups, as general apparatus, accessory apparatus and special apparatus.

The first step in locating any apparatus was to approach the longest serving member of the Department, Jim Pollard, who was on the staff before the University moved to its present site. He was enthusiastic about the project and together we formed an informal history committee to co-ordinate the project. All the places in the Department which were likely to hold material, such as storage rooms, cupboards and dark corners, were searched. Anything that appeared old was appropriated. Another staff member, who it was discovered held a number of items, was approached, and he gladly gave these up to the greater cause of history. The apparatus was then collected together in one place and an initial catalogue prepared. In this regard, particular attention was given to any writing on the apparatus, as well as the suggestions of various staff members as to identity. With the assistance of Barry Anderson, a friend knowledgeable about old cameras and old materials generally, the apparatus was variously

disassembled, cleaned and oiled or waxed. This process allowed for a greater understanding of the apparatus than would have the simple observation of each piece, because it involved both an active exploration of the instruments, inside and out, as well as the expenditure of a great deal of time. The benefits likely to accrue from "the restorative process" were noted also by Sokal et al (1975).

Because the apparatus were mysterious, as to identity and function, part of this process involved various attempts to decipher the function of each piece, using the clues provided by the apparatus themselves. A search of old psychology dictionaries, text-books, articles and so forth, resulted in the positive identification of every piece, and in some cases, the discovery of considerable detail relating to function and operation.

It was decided that, in this situation, the best way to preserve the apparatus was to exhibit it in a display case. This not only would keep the apparatus safe, but would also give a higher profile to the History of Psychology as a sub-field, within the Psychology Department, at the University of Canterbury. At the time of writing, a large display cabinet, with glass front and sides, has been installed in a prominent corridor location in the Psychology Department, and a display is being organised.

# Description of the Apparatus

## Vernier Chronoscope

The Vernier Chronoscope provided a means of measuring reaction time, where the accuracy of measurement required was no more than 1/50-th of a second (Sanford, 1898). It was primarily for demonstration purposes, and had been so developed in its original form (Sanford, 1898), but because it was inexpensive it

was a natural candidate for use in laboratory class experiments, where it was used to measure simple reaction times (Titchener, 1901/1918). Sanford (1898) however, suggests it could be used in a wide range of reaction time research, including that associated with auditory, tactual and visual stimuli, as well as "reactions involving discrimination and choice [and] number association" (196).

The original apparatus (figure four) was first described by its inventor, E.C. Sanford, in 1890. It consisted of two rigid pendulums, each of which swung across an arc at a different but known rate. The first pendulum was activated simultaneously with the presentation of a stimulus and the second as the experimental participants made their responses. The number of swings of the two pendulums were counted until they coincided. The number of swings taken to reach this point were added, and various calculations were made to reveal the reaction time. The pendulums were held in place by electromagnets, and were released by the breaking of a circuit. The original apparatus was large and

> well suited to lecture demonstration, for a whole roomful can easily see that one pendulum starts before the other, and can count the swings to a coincidence, to all intents taking part in the observation themselves (Sanford, 1890, 181).

A later version of the apparatus (figure five) evolved from the earlier version, because, according to Sanford's own account, he required a quantity of reaction time apparatus for a summer school he was running. The new apparatus worked on the same principle, except the pendulums consisted of brass bobs suspended by string. They were held separately at one end of an arc by two telegraphic keys. Their release was therefore a simple matter of pressing the appropriate key, which would start the bob swinging through its full arc.

The apparatus pictured (figure six), is the same as that described by Sanford (1898), except that the bobs are metallic, which suggests a later date of manufacture for this item.

## Hipp Chronoscope

The Hipp Chronoscope (figure seven) was used for very accurate measurements of reaction time, in units as small as 1/1000-th of a second. Its use of changes in an electric current made it sensitive to small time differences. The Hipp Chronoscope is such a well known piece of apparatus and referred to by so many writers (e.g., Sokal et al, 1976; Caudle, 1983; Warren, 1935; Baldwin, 1911; Myers, 1911; Turtle, 1979) that only a brief description is offered here. Along with the Kymograph, the Hipp Chronoscope was a fairly standard item of laboratory equipment, which perhaps explains the widespread familiarity with it amongst psychologists.

The Chronoscope consisted of a clockwork mechanism (figure eight) powered by a weight. Two clocks (figure nine), one measuring seconds and tenths of seconds, the other one hundredths and one thousandths of seconds, were actuated and stopped by the action of electromagnets, commonly called 'bobbins' (figure 10) (Warren, 1935). The operational procedure involved in measuring a reaction time involved firstly, beginning the clockwork. Then a stimulus was presented to an experimental participant. The stimulus presentation involved the electromagnets by opening or closing a circuit, and thus beginning the movement of the clocks. The participant's response, in turn, opened or closed the circuit and stopped the clocks. The resulting time was the reaction time. By estimating the time taken for the in-going and out-going impulses of the participant, his or her central reaction or processing time could be estimated

(Baldwin, 1911). This seemed to offer to measure the time involved with thinking.

A detailed account of the mechanical workings of the apparatus is given by Myers (1911). The use of the Chronoscope required accompanying equipment. In the simplest case, where simple reaction time was measured, a battery, a stimulus and a response instrument were all required, as is illustrated by figure 11.

The Hipp Chronoscope was not without its problems and disadvantages. Sokal et al (1976) suggest, for example, that Wilhelm Wundt may have misused the instrument, because he thought that the action of the electromagnets was instantaneous, whereas according to Cattell (in Sokal et al, 1976) it involved something over a tenth of a second. Additionally, the response time of the electromagnets was open to variation, because of the effects of magnetisation. Cattell and Dolley (1895) found that by replacing the regular wire around the electromagnets with a coarser type, the "latent time of magnetisation and demagnetisation" was significantly decreased.

Cattell and Dolley (1895) mention further problems. They caution that care had to be taken when beginning the clockwork, activated by pulling on a string, because, "unless the string be pulled with a given force and to a given extent the clockwork is apt not to start properly" (396) and suggest replacing the string with a clockwork device. An irritating limitation to the apparatus was that it had a total running time of only one minute (Cattell & Dolley, 1895), which was presumably the time the weight would take to reach its lowest point. Although this caused little problem when measuring short reaction times, it did mean that the apparatus had to be "stopped after each experiment" and reset, which was no doubt a rather irksome task.

The apparatus held by the Psychology Department, University of Canterbury, appears to be in working order, at least as regards the clockwork, although it is minus its glass dust cover. Some of the strings are either in bad condition or are not original. The materials of construction comprise an odd mixture. While the legs are made from what appears to be cast iron, the platform on which the clockwork and electromagnets sit is of marble. This rather incongruous combination, suggests a date of manufacture in the 1920's, a transitional period when apparatus were manufactured to be more purely functional than was the case for earlier apparatus.

Only one photograph of this particular apparatus in use at Canterbury College is known to exist. It was taken on the occasion of the Canterbury College Scientific Society Conversazione, held at the College in 1934 (Press 3/5/34). The Conversaziones were held every three years and were very popular amongst the public, because they allowed the opportunity of seeing various scientific displays and demonstrations, based on work of a scientific nature being done at the College.

## Kymograph

There is a wealth of information available relating to the Kymograph (e.g., Warren, 1935; Underwood, 1949). This is because the Kymograph was, as Titchener (1901/1918) described it, "one of the corner-stones of laboratory equipment" (172). The Kymograph, originally borrowed from physiology, was a recording device which produced a graphic record. The standard apparatus could be adapted to measure any physiological or muscular process (Turtle, 1979; McPherson et al, 1967) by the addition of "special purpose measuring instruments" (Davis & Merzbach, 1972, 3) such as the Sphygmograph (blood

pressure) and Pneumograph (breathing). Titchener (1901/1918) suggested that it could record "any process whose course is the function of time elapsed" (172). The graphic record which was produced, was in effect a two-dimensional curve, one dimension of which represented time (Baldwin, 1911).

The basic apparatus consisted of a cylinder which was driven at a constant rate by a motor. The record was made on paper which was wrapped around the cylinder or drum. The speed with which the drum rotated could be varied. There were numerous variations on these basic aspects. This is perhaps not surprising considering that the apparatus was used almost universally by experimental psychologists. The motor for example, could be powered by clockwork, steam, gas, water, weights, electricity or by hand. The drums were typically made of brass before about 1920, but other materials sometimes used included aluminium, glass and plastic. The paper on which recordings were made could be glazed, waxed, smoked, or simply ordinary paper and the means of marking it included "ink, dye, soot, pointed steel tips, aluminum foil, electric sparks and [photographic procedures]" (Davis & Merzbach, 1972, 5).

The basic apparatus could not be used on its own. It required numerous accessories for its operation. The clockwork Kymograph held by the Psychology Department, University of Canterbury, for example, although in working order, cannot be used without various additional pieces. The apparatus which measured the bodily process varied according to what was being measured. The stylus, which marked the paper, depended on the measuring apparatus for its form. Measurements involving air pressure, for example, utilised the Marey Tambour (Baldwin, 1911) and a special stylus which was activated by changes in air pressure, transmitted by the Tambour (Titchener, 1901/1918).

There was a second type of accessory apparatus, whose nature did not rely on the type of research conducted, and was common at least up to the turn of the century, when smoked paper was still in common usage. The use of smoked paper was a complicated, messy and smelly business. A summary of Titchener's (1901/1918) detailed description is provided here. The Kymograph paper was commercially supplied in strips which were the width of a drum and 5 mm longer than its circumference. It was "fairly tough" and glazed, but required the application of a layer of smoke before use. The method of recording with smoked paper, involved a stylus which marked the paper by removing the soot along its course. The result was something like a negative image, with the curve being light and the surrounding paper dark.

Smoking involved placing two drums on a smoking stand (figures 12 & 13). One drum held the blank paper, which was smoked by a "small petroleum-burning lamp with broad wick" as it was moved onto the other drum. The procedure was delicate and required a lot of practice for its successful completion, as shown by Titchener's description.

> As the drum is turned, the lamp-flame is held close up under it, and the lamp is moved fairly quickly from right to left and back again, so that the smoke traces broad spirals of soot upon the white paper. The rate of turning must be learned by practice. The paper should be evenly, but not too thickly, coated with the brownish-black soot. It is, upon the whole, better to work with a mere grey film of soot than to have the drum-surface overloaded; though the right amount of smoking varies with the writing-point" (Titchener, 1901/1918, 173-74)

Another method, recommended by Whipple (1924) as superior, was to remove the top from an oil stove and hold the paper over the hole. This was supposed to involve less soot and heat than the lamp method.

Titchener suggested preparing two drums of paper at one time, as then an experiment need be interrupted only for a short time when more paper was needed. The spare drum was kept on a special stand (figure 14), although Titchener observed that a modified packing-box would do just as well. Once the record was made, the paper was removed by a scalpel and identifying details were added. Titchener (1901/1918) cautioned against overlooking this latter point, because "curves easily 'get mixed'; and nothing is more aggravating than to possess a good record which cannot be certainly identified" (176). The sheet containing the record was then varnished "for permanent keeping". This involved bathing the paper in a solution, comprising "10 parts of white shellac in 100 parts of 90% alcohol" (175) and finally hanging it to dry (figure 15).

A number of single sheets could be joined to form a roll of longer paper, in which case a second drum was required. Despite the advantage of being able to make longer records, and therefore longer experiments, the seam joining each sheet was likely to cause problems. Titchener warned that,

> The direction of writing [must] be <u>from</u> the double thickness of paper <u>to</u> the seam, and not vice versa. If this rule is not followed, the writing-point will hitch over the seam, when the drum comes round to it: the point may be deranged, or a critical portion of the curve spoiled" (Titchener, 1901/1918, 179, original emphasis).

The smell associated with smoked paper was another potential problem. Titchener described it as "very intensive" which to some experimental participants was "very disagreeable". For this reason, it was recommended that the smoking process was not conducted in the experimental rooms. Perhaps for

this reason, Martin (1906) devoted room space in his new laboratory especially to the purpose of smoking Kymograph paper. He evidently considered this such an important part of the laboratory that two rooms were so designated.

Titchener, although he described the procedure for smoking paper in detail, did not have much regard for it and was eager to use alternative methods which were undoubtedly less smelly. He wrote that,

> there are three things for which the a laboratory is disquieted: primary batteries, smoked paper and mercury. The ideal laboratory will be able to dispense with them; I am sorry to say that we have still some need of all three (Titchener, 1898a, 317-318).

Other problems were also associated with the Kymograph. Davis & Merzbach (1972) note that maintaining a regular rate of rotation was of concern, as was deciding what the speed of rotation should be. This latter point invariably depended upon the phenomenon under investigation. Nerve impulses, for example, required faster speeds of rotation if they were to be meaningfully recorded. Titchener (1901/1918) pointed to a potential problem involved in the variability of friction between the stylus and paper. The friction could be affected by variable rotation, paper which was not smooth and an uneven coating of soot.

Despite problems with the use of the apparatus, its essential accuracy and reliability were unquestioned. This attitude is illustrated by Titchener who considered that the Kymograph record was so accurate as to be used for the checking of participants' introspective accounts of an experiment.

> It is probably true of all subjects, even the most conscientious and experienced, that they feel a certain timidity and reserve when called upon to give an introspective account of the experiment. The kymograph curve

> seems to be so remote and out of reach that one despairs of ever matching its impassive facts by one's scrappy and hesitating sentences. Hence the exactness of this match - the precise parallel, breath for breath, of objective and subjective repose and of objective and subjective disturbance - comes as an almost startling revelation. When once [the Observer] has realised that the curve obeys his interpretation, - that it honestly reflects the turn of his head in his collar, the slight shift of his body in the chair, the unpleasant memory that forced itself upon him ...; while, on the other hand, it betrays everything that he has been tempted, half-consciously, to conceal ...; he settles down resignedly into the required passive attitude, and lets the experiment go on as a matter of course (Titchener, 1901/1918, 181-82).

The apparatus in figure 16 is driven by clockwork (figure 17) and produces a not inconsiderable amount of noise. Soot-like marks on the cylinder and the presence of a second cylinder, indicate that it was used with smoked paper. A quantity of glazed paper rolls was also found, but as these are continuous, without joins, and are not as wide as the paper described by Titchener, they were probably produced somewhat later. The apparatus was manufactured by the American apparatus company, C.H. Stoelting. The drum has a rate of rotation which may be adjusted. According to Whipple's (1924) description of a Kymograph of the same type (figure 18) the rate of rotation varied between "one revolution in ten seconds to one revolution in ten minutes" (118). The apparatus could be used either upright or on its side (Crafts et al, 1938). In the latter case, two metal feet could be fitted to the side of the base. A third foot was permanently attached near the top of the apparatus.

A second, more modern Kymograph (figure 19) is also held by the Psychology Department, University of Canterbury. Manufactured by C.F. Palmer, it is mains powered, and in working order. However, the rather delicate structure (not pictured) associated with paper feeding and movement is, unfortunately, broken.

## Electromagnetic Tuning Fork

The example pictured (figure 20) was manufactured by C.F. Palmer and looks similar in appearance to a cut (figure 21) provided by Whipple (1924). As the name suggests, the apparatus consists of a tuning fork (mounted on a wooden platform) and an associated electromagnet which allowed for precise control of the initiation and cessation of vibration of the fork. The apparatus required a battery as power source and was used in conjunction with other apparatus such as the Hipp Chronoscope and the Kymograph. With the latter, a point was attached to the fork, and once set to vibration, would leave a trace on the Kymograph paper which provided a time scale against which participants' responses could be measured.

## Resistance Box

The Resistance Box was a device for "regulating [the] strength of electric potentials" (Baldwin, 1911, 468). It consists of a number of coiled wires of specific resistances and an arrangement of knobs to regulate the current. The example held by the Psychology Department, University of Canterbury (figure 22) has three terminals, one marked "patient", a second marked "battery" and a third "galvo". Baldwin (1911) describes it as an accessory apparatus, and it was used in this role in the Canterbury College laboratory for psycho-galvanic measurements, as described in the previous chapter.

The example in figure 22 was manufactured by Gambrell Brothers Ltd, London. The wire coils are enclosed by a wooden box with a lid that appears to be made from bakelite. This was a plastic-like material used for purposes of insulation

during the 1920's and before (Oxford English Dictionary, 1989). This apparatus was therefore manufactured no later than the 1920's.

## Colour Mixer

The example in figure 23, was probably made by James Shelley. According to Crowther (1991), Shelley made a number of these, including one for show purposes. The example held by the Psychology Department, University of Canterbury, is one of the ordinary pieces. Given that a number were constructed, the apparatus was probably used in the laboratory as part of instruction in experimental psychology, where several pieces of the same apparatus would facilitate the teaching process. This further indicates that they were made possibly late 1920's or early 1930's, when laboratory classes were bigger and so more examples of any apparatus were required.

The Colour Wheel was designed to hold two colour disks. The operation of a crank-handle operated a complex combination of cogs which in turn moved the discs in a circular motion. However, one of the disc holders of the example held the Psychology Department, University of Canterbury, is unfortunately, broken. The apparatus was made from a combination of French Mechano parts, as well as metal and wood that was locally engineered and turned. After some adjustment and oiling, the apparatus worked well, although was very noisy because of the large number of interlocking cogs. Apart from its probable use in laboratory classes, the apparatus may have been built as a result of or as part of the process of Shelley's construction of a theory of colour, as mentioned by Beeby (chapter four).

## Perimeter

The Perimeter was "an instrument for mapping the retinal field" (Warren, 1935, 196). The apparatus (figure 24) consisted of an arm or quadrant which could be moved to any angle. The arm contained a scale ranging from 0 - 90 degrees, along which a stimulus could be moved. At the rear of the apparatus, a pointer recorded the position of the arm on a map. This comprised an x and y axes, representing up, down, left and right. The experimental participant placed his or her neck on a rest and fixated on a position designated by the experimenter (fixation stimulus), which represented the centre of the x and y axes on the corresponding map. By moving the arm and stimulus through a number of points in space, and noting whether the participant was able to correctly discern the stimulus, a map of the retinal field for that stimulus (a colour for example) could be made. Figure 25 shows a typical map.

A typical procedure which included colour, involved moving the stimulus inwards towards the centre of vision "until the colour [was] correctly distinguished" (Baldwin, 1911, 608). Apart from the limits of colour discrimination, the Perimeter was also used for determining the space threshold and the blind spot (Baldwin, 1911).

The apparatus held by the Psychology Department, University of Canterbury (figure 26) appears the same in almost all respects to the description of a typical Perimeter. Because this was a very specialised apparatus in comparison to some other apparatus such as the Kymograph, the Perimeter was probably an instrument that had few varieties of form. One feature of the instrument in figure 26 however, that is individual, is the fixation stimulus, which consists of a small white ball, possibly made of ivory, mounted forward of the chin-rest. The

apparatus is stamped "McHardy's Perimeter, Curry and Paxton, 1885." How, or when, it made its way to the Canterbury College laboratory is unknown.

## Focal Plane Shutters

The Focal Plane Shutters shown in figure 27 were most likely used for the presentation of a stimulus for a measured amount of time. The apparatus consists basically of a shutter which can be closed in a specified time period. The time may be adjusted for a number of speeds. A stimulus, such as a letter, number or word, could be placed behind the shutter and revealed briefly. This would have been of use in experiments involving perception and recognition.

The smaller apparatus was from C.H. Stoelting and the larger from Thornton Pickard, an English manufacturer of cameras. The Stoelting piece was probably bought from a camera manufacturer, modified, and then distributed to psychologists as psychological apparatus. The fact that the Stoelting apparatus is stamped "Made in England" supports this view.

## Resonators

'Resonator' is a general term for any of the three varieties of device designed for "magnifying the intensity of a tone of some given pitch" (Warren, 1935). The three types of Resonator were the Helmholtz (figure 28), the Koenig (figure 29), and the Appun. All consisted basically of a hollow chamber, "funnel-shaped at the one end for insertion into the ear, and open at the other to the surrounding air" (Titchener, 1901/1918, 76). If a tone was sounded that the Resonator was designed to respond to, the air inside the Resonator was "thrown into powerful

sympathetic vibration, and the tone 'bray[ed]' into the ear" (Titchener, 1901/1918, 77). For the best results, Titchener recommended that the funnel inserted into the ear be made to fit as closely as possible. This was accomplished "by means of a piece of rubber tubing slipped over the metal, or a coat of sealing-wax which is pressed into the ear while still warm and soft" (Titchener, 1901/1918, 77).

The Helmholtz Resonator was spherical, the Koenig Resonator cylindrical and the Appun conical. The tone of each Resonator depended on a number of factors, including, "its air capacity, the diameter of the openings, its shape, [and the] temperature of the vibrating medium" (Warren, 1935, 232). Each of the Helmholtz Resonators responded to a specified tone. A complete set comprised spheres in a range of sizes. The Koenig Resonators however, were capable of responding to several tones. They were made from two cylinders fitted together, movement of one cylinder out of the other creating an increased air-space and therefore altering the responsiveness. The tones to which the Koenig Resonator responded were marked on the inner cylinder in French notation. In the case of the Helmholtz Resonators, each individual sphere was marked with the unique tone to which it responded.

Opinions vary as to how many cylinders comprised a full set of Koenig Resonators. Titchener (1901/1918) suggested that 14 completed the set, but Davis & Merzbach (1975) say that the number was 22. The discrepancy probably arises from more Resonators being added to the Koenig range after Titchener wrote of them.

The Resonator was originally developed last century by Helmholtz in conjunction with his theory of resonance. Helmholtz believed that the ear contained separate structures, each of which vibrated in response to certain tones

(Davis & Merzbach, 1975). "Helmholtz likened these", says Turner (1983), "to the strings of a piano, and conceived of them as acting like tuned resonators" (142).

Helmholtz's Resonators were initially made of glass, but later brass was used. Titchener (1901/1918) notes that the Appun Resonators were made of zinc. The examples of Resonators held by the Psychology Department, University of Canterbury, are two Helmholtz Resonators and one Koenig Resonator. All are constructed of some metallic material, but not brass, which indicates that they are of relatively modern construction, possibly 1920's vintage. The markings on the larger Helmholtz Resonator are, e1 = 320 and on the smaller, g1 = 384. Those on the Koenig Resonator are, gis1 = 400 and e1 = 320. Resonators were an extremely common laboratory apparatus, and most laboratories had at least one type of Resonator (Davis & Merzbach, 1975).

## Shock-plate

The Shock-plate (figure 30) was most likely built by Shelley or Beeby in the workshop of the Canterbury College laboratory. It has the appearance of a non-commercially manufactured instrument. It consists of a brass plate mounted flat onto a wooden board. Separated from the plate is an upright brass post. Inspection of the under side of the board reveals wires connected to the brass fittings. These were probably connected to a battery. An electrical circuit was then made by placing the palm of one's hand on the flat plate and touching the

post with an extended finger. The current was probably moderated by the addition of a rheostat.

Crowther (1991) mentions the use of the apparatus to deliver shocks to students, which confirms its use as a device for administering electric shocks. Crowther notes that at least one student suffered rather badly from a shock which had been set at too high a level. The purpose of administering electrical shocks to students is unknown and no documentation of anything resembling this apparatus could be located in early articles about experimental psychology. One use however, may have been in conjunction with the Psycho-galvanic device mentioned by Beeby (chapter four). Given the availability of a measure of emotion, as the Psycho-galvanic device was believed to be, noting the effects of an electric shock on the emotions may have been of interest to the experimenters of the Canterbury College laboratory. The Shock-plate may also conceivably have been used as the second or competing stimulus in attention experiments involving the McDougall Dotter. While receiving an electric shock was in no sense a task, it would have been of interest to quantify the changes in attention induced by such a violent stimulus.

## Steadiness Tester

The Steadiness Tester (figure 31) was one of a variety of tests designed to measure physical and motor capacity (Whipple, 1924). Specifically, it measured the precision or steadiness of voluntary movement. The apparatus consists of a flat board, on to which are attached two converging metal strips. The experimental participant was required to move a stylus between the strips, from the wider end to the narrower end, attempting in the process to keep the stylus from contact with the strips. Should contact occur, it was registered on a

"telegraphic sounder, bell, electric counter, or graphic record" (Whipple, 1924, 152). The position of the contact was indicated by a ruler running alongside the metal strips. The metal strips could be configured in a number of ways, including parallel, curved or scrolled. The use of the apparatus involved a battery to generate the electric current required.

Whipple (1924) pointed out that the Steadiness Tester was often described as a regular steadiness test, but he considered it to be somewhere between this and an accuracy test, because, the Steadiness Tester "measures control of voluntary movement, whereas [a regular steadiness test] measure[s] the extent of involuntary movement which takes place when the hand or arm is held at rest" (151). The test, said Whipple, involved the continuous movement involved in drawing a line, which had been described by Bryan as a "'writing movement'" and was measured by Bagley in a "'tracing test'".

A typical series of experiments is described by Whipple (1924), who notes that other authors correlated the results from the test with factors such as sex , mental ability and social status. Generally males were steadier on the test than females, and the steadier individuals were less intelligent, but had more social status, than less steady individuals.

The apparatus held by the Psychology Department, University of Canterbury (figure 32) is the same as that described by Whipple (1924). It was manufactured by C.H. Stoelting and ordered by Canterbury College in 1928. It retailed at US$10.00 (Registrar to C.H. Stoelting 31/10/28).

## McDougall Dotter

The McDougall Dotter was first designed and built in the early 1900's by W. McDougall in England. McDougall (1904-5) introduced and outlined his new apparatus, which was designed as a reliable and objective measure of attention. Attention had been a popular field of study and many efforts had been made to measure it. One typical method was to have a person perform two tasks concurrently, such as reading a passage while at the same time adding figures being recited. Another method involved a comparison of quantity and accuracy of a task performed with and without some "disturbing sensory stimuli".

The problems with such methods, concluded McDougall (1904-5), was that they provided no objective record of the attention process and didn't "guarantee the uninterrupted direction of attention to one task" (435). McDougall's apparatus and its associated method countered these problems by providing an "objective or graphic record of any failure of continuity of attention and also an objective measure of the accuracy with which the task has been performed" (436).

The apparatus consisted basically of a clockwork driven cylinder. The clockwork was powered by a weight "pulling on a cord wound on a small drum, which transmits, by means of systems of cog-wheels, a rapid motion to a pair of wind-sails and a slower motion to a large cylinder" (436). The rate of rotation of the cylinder could be varied by simply modifying the weight. A long roll of continuous paper, attached to the cylinder, contained eight rows of small (1.5 mm) open circles, or "spots" arranged in a variable pattern. An adjustable screen covered the circles from view, except for a small number which the experimental participant was required to attend. The participant was required to place a mark

in each circle, using a pen or "stylograph". The typical procedure involved the participant marking circles while the cylinder rotated slowly. Gradually the rate of rotation was increased until the participants' full attention was required merely to correctly and accurately mark the circles. At this point, another task, such as adding recited figures, was introduced. Whatever the second task, in all cases the marked tape provided an objective and standard record of changes in the attention of the participant.

McDougall considered that his apparatus had possible application for the study of a number of attention related phenomena, including,

> the onset and passing away of fatigue, excitement, and practice, or of the influence of fatigue, drugs, rest, etc. upon capacity for mental work, or for studying the changes in this capacity for mental work, or for studying the changes in this capacity that take place [over time] (McDougall, 1904-5, 439).

According to Warren (1935), the dotting procedure could also be used as a test of the speed and accuracy of voluntary movement.

The apparatus held by the Psychology Department, University of Canterbury (figures 33 & 34) displays some differences in physical form from McDougall's original apparatus, but it retains the same underlying principle and in practice would have been operated in a similar manner. It has a clockwork motor, but this uses power stored from the action of a hand crank, in the same manner as a gramophone. The cylinder is thinner, as only one row of circles is used, instead of eight. The rate of rotation is varied by a simple lever. The entire apparatus is enclosed in a wooden box-like structure with an adjustable opening which reveals circles for viewing and marking.

Apart from being, in all likelihood, considerably smaller, more portable and easier to operate than the original, this latter apparatus is also probably a good deal quieter, because it is totally enclosed. This instrument was produced no later than 1934, in which year it was shipped to the laboratory at Canterbury College. It was produced by the English apparatus company, C.F. Palmer, and retailed at £13 which included one free roll of special paper (C.F. Palmer to Registrar 24/8/34).

It is unfortunate that we have information relating to only two points in the evolution of this apparatus. It would prove interesting to have details of changes in the apparatus in the almost 30 years between 1905-1934, which would allow the evolution of the piece to be charted.

## Phrenological Bust

The Phrenological bust (figure 35) was not used at the College for the study of phrenology. According to Crowther (personal communication, 1991), it was purchased by her husband, Professor Alan Crowther as a psychological curiosity during a visit by him to England. The bust indicates the phrenological divisions of the brain. The item pictured was made by L.N. Fowler.

Figure 1. Laboratory Establishment Dates as Reported by Garvey, 1929, (1875-1911)

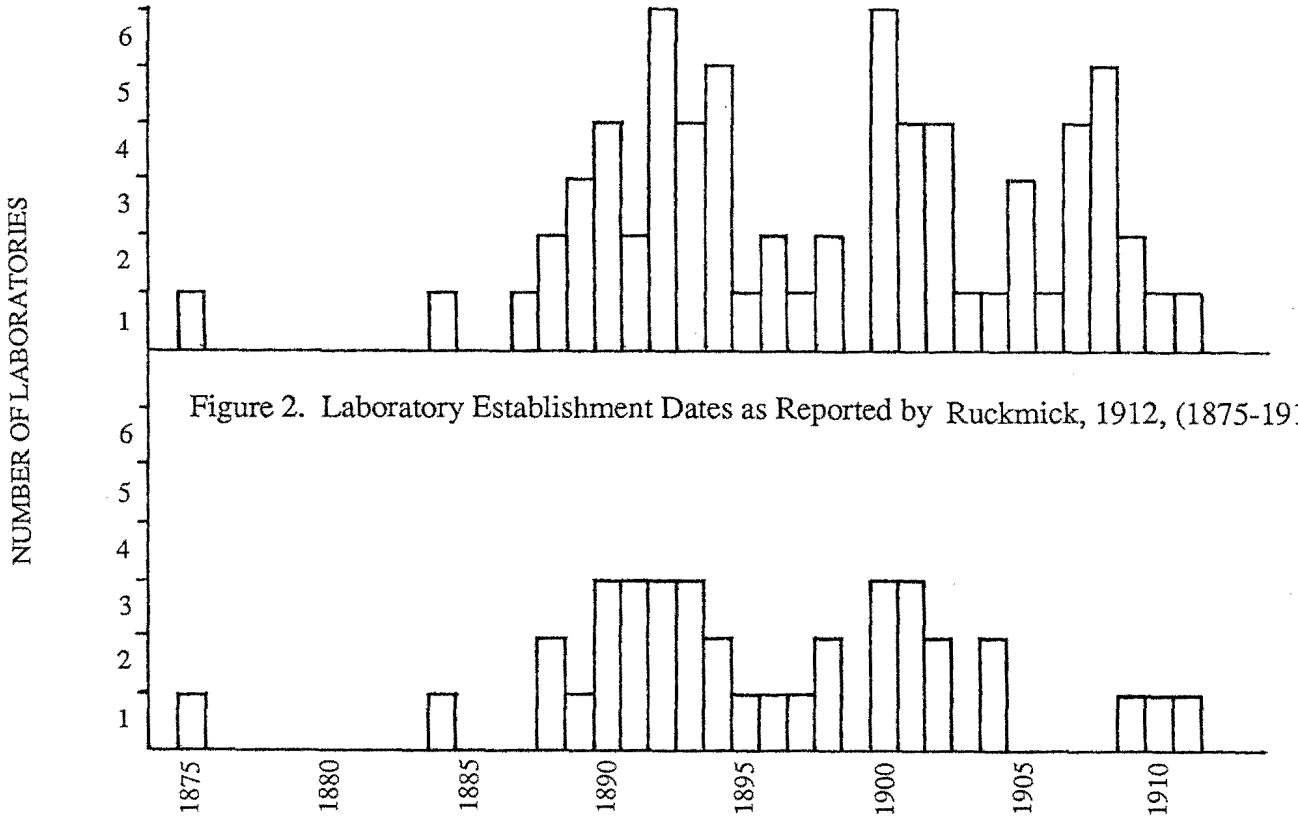
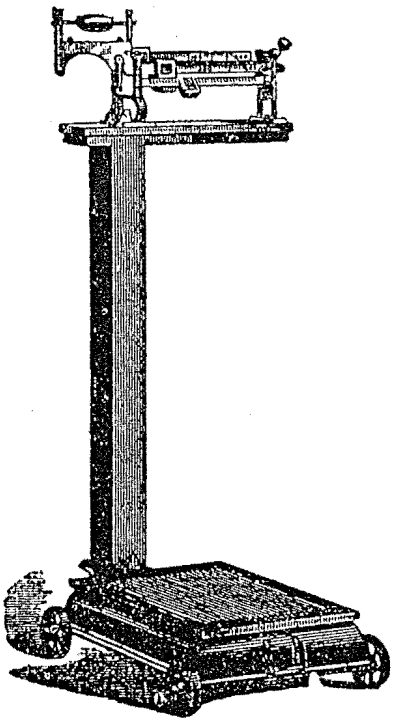
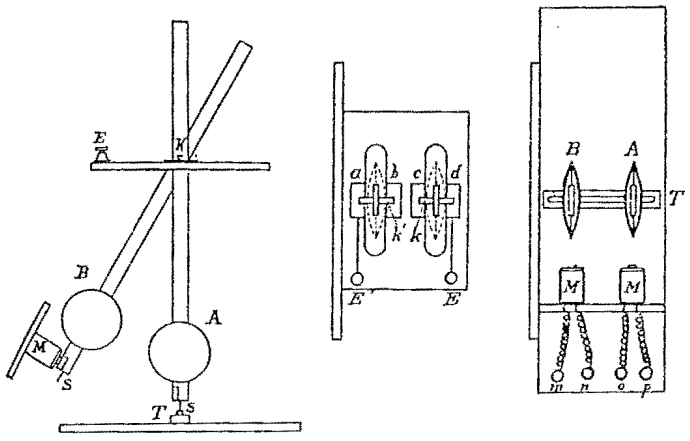
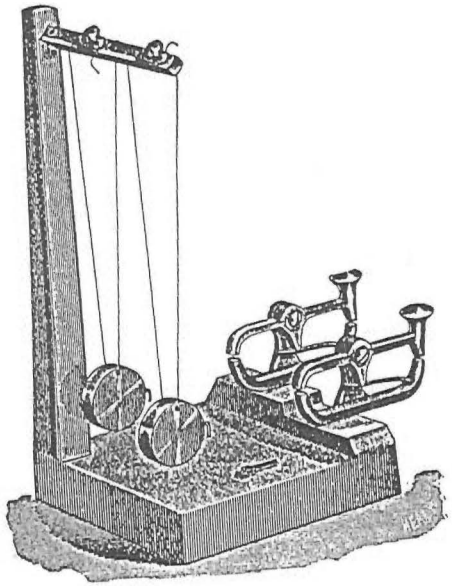


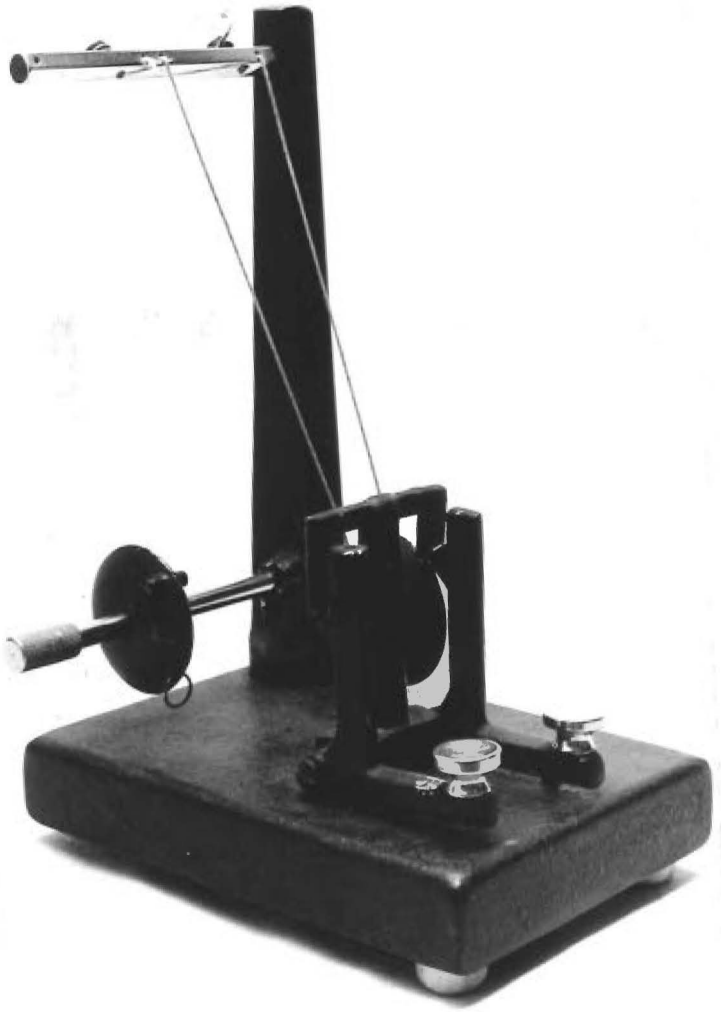

Figure 2. Laboratory Establishment Dates as Reported by Ruckmick, 1912, (1875-1911)



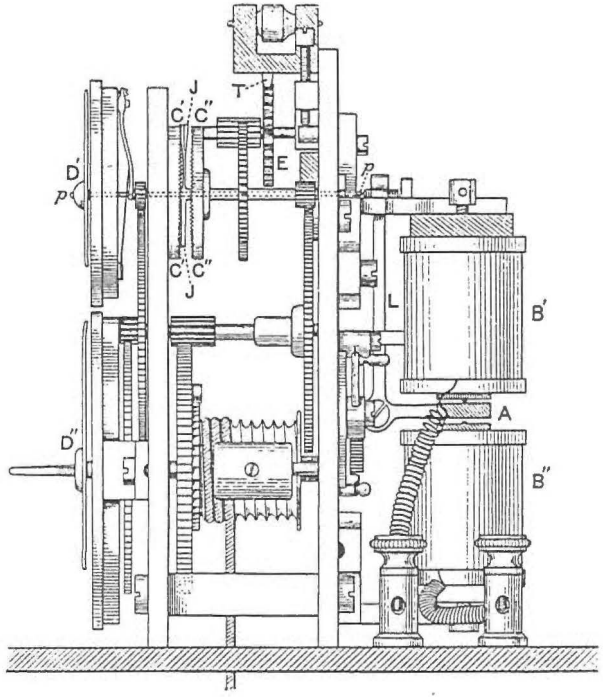
ABOVE Figure 3. Anthropometric Scales (Whipple, 1924)
BELOW Figure 4. Vernier Chronoscope (Sanford, 1890)



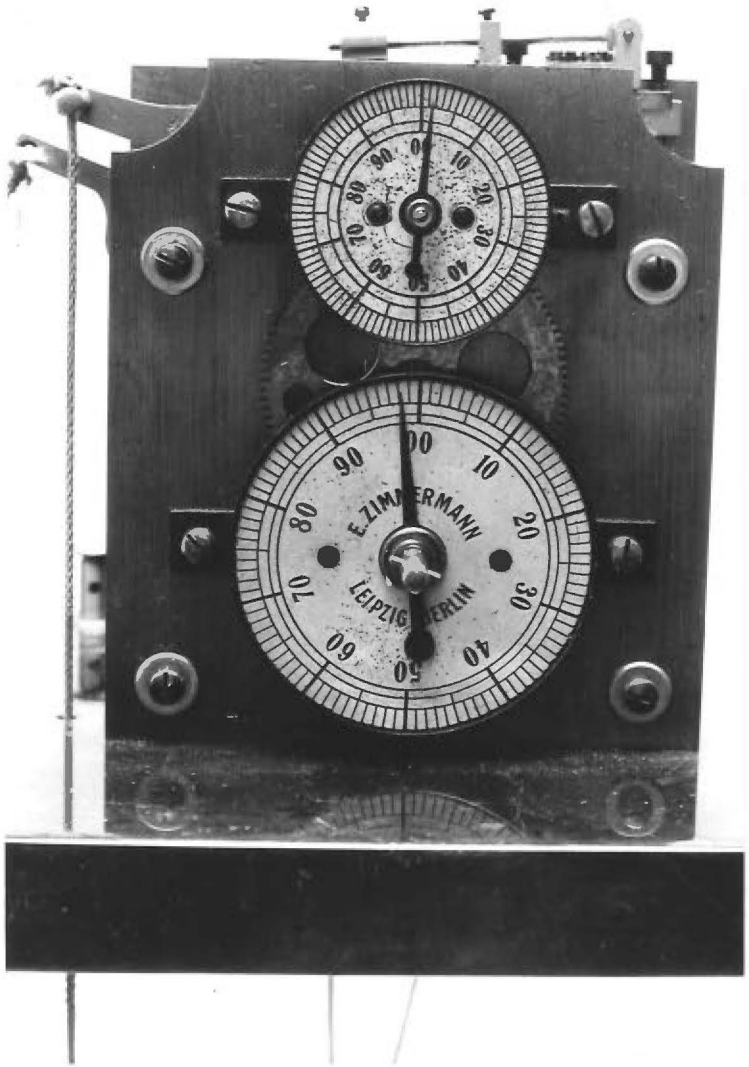


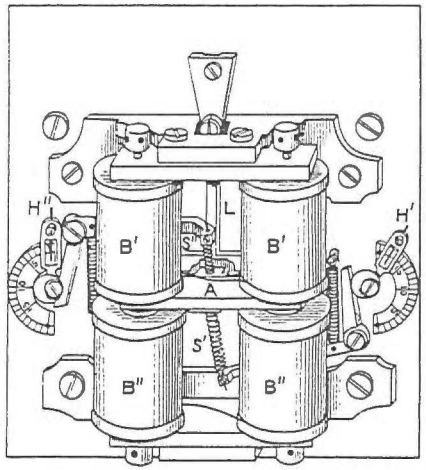


ABOVE Figure 5. Vernier Chronoscope (Sanford, 1898)
RIGHT Figure 6. Vernier Chronoscope




LEFT Figure 7. Hipp Chronoscope, Zimmermann
ABOVE Figure 8. Side view of Hipp Chronoscope clockwork mechanism (Myers, 1911)




LEFT Figure 9. Hipp Chronoscope clock faces, Zimmermann
ABOVE Figure 10. Hipp Chronoscope electromagnets (Myers, 1911)

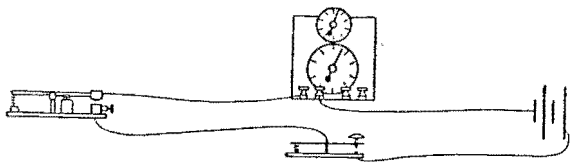


Figure 11. Simple reaction time set-up including Hipp Chronoscope (Myers, 1911)

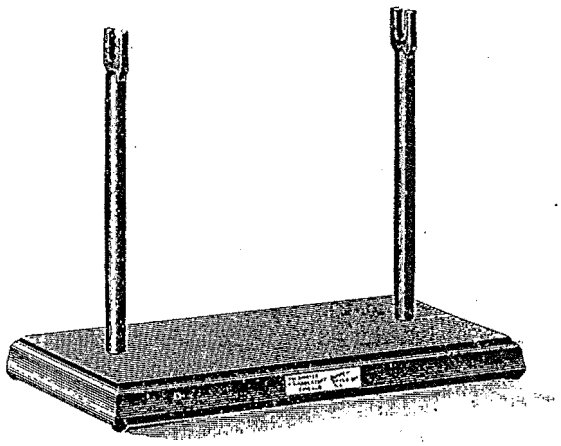


Figure 12. Smoking Stand for Kymograph drums, Chicago Laboratory Supply & Scale Company (Whipple, 1924)

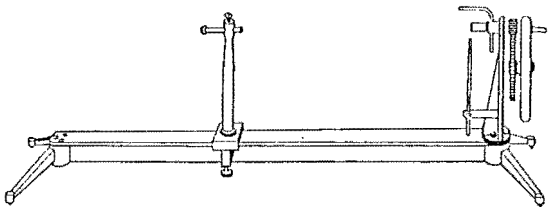
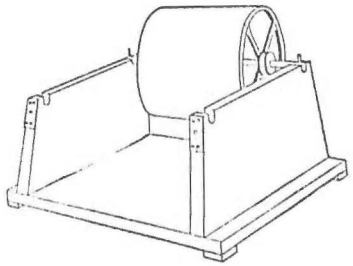
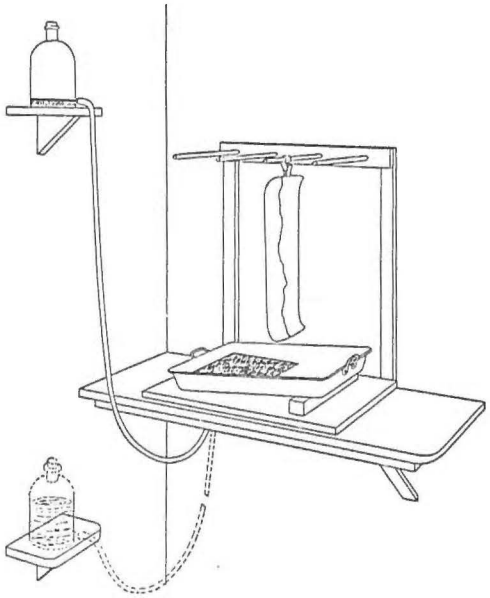
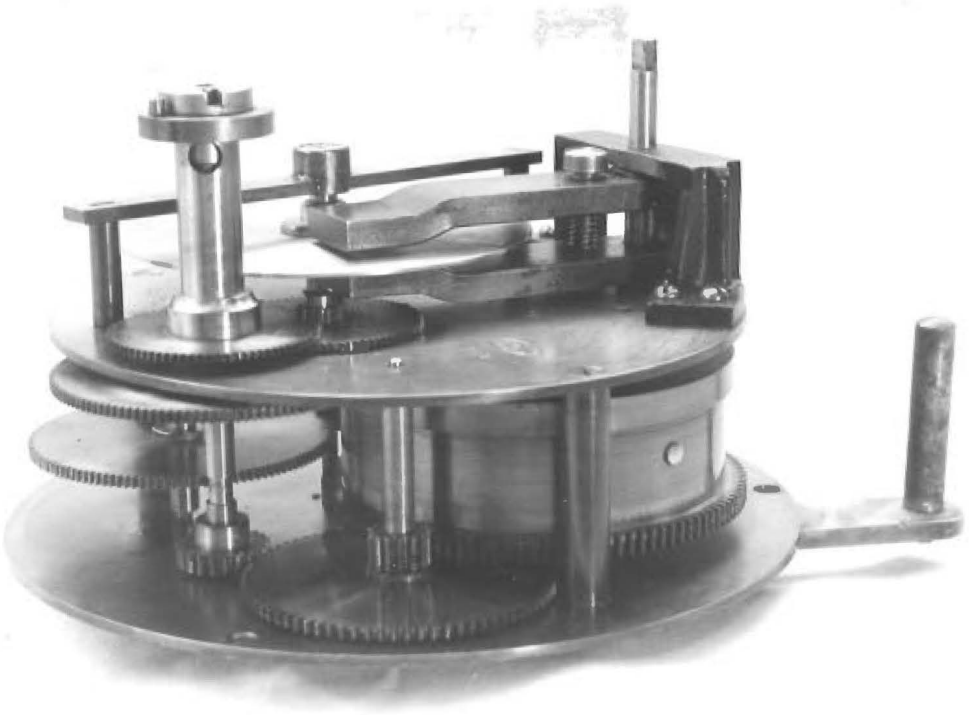


Figure 13. Smoking Stand for Kymograph drums, Zimmermann (Titchener, 1901/1918)

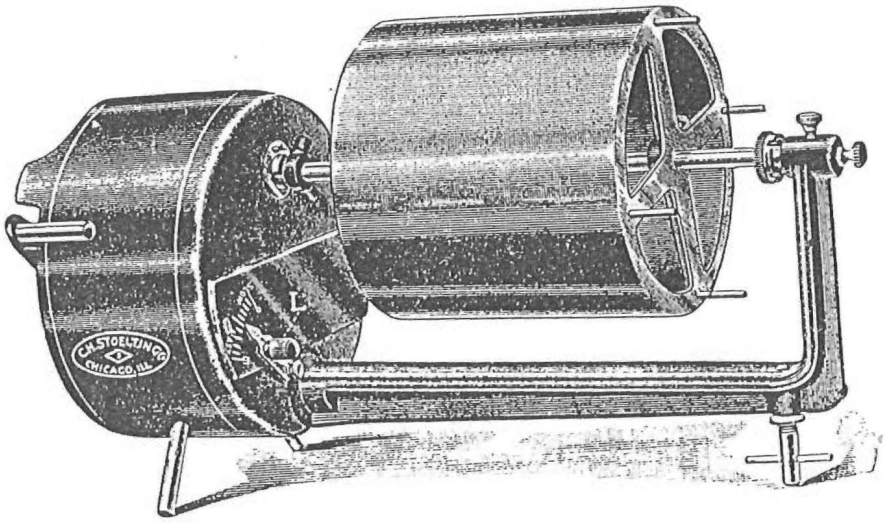


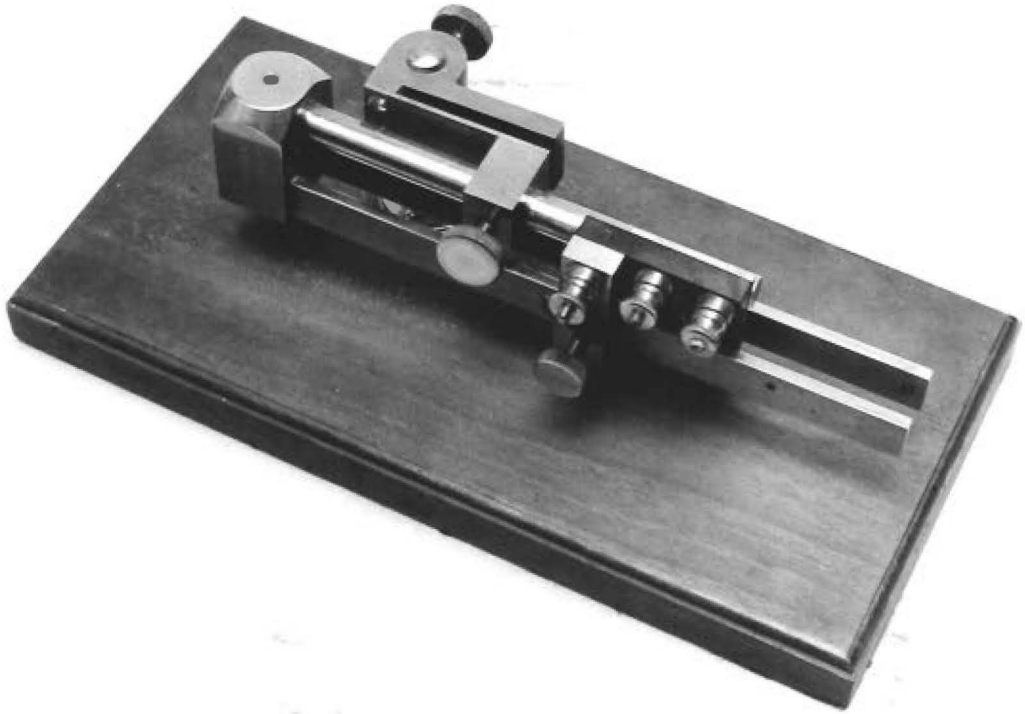


ABOVE FAR LEFT Figure 14.
Stand for Kymograph drums
(Titchener, 1901/1918)
BELOW FAR LEFT Figure 15.
Varnishing arrangement for Kymograph
paper (Titchener, 1901/1918)
LEFT Figure 16.
Clockwork Kymograph, C.H. Stoelting

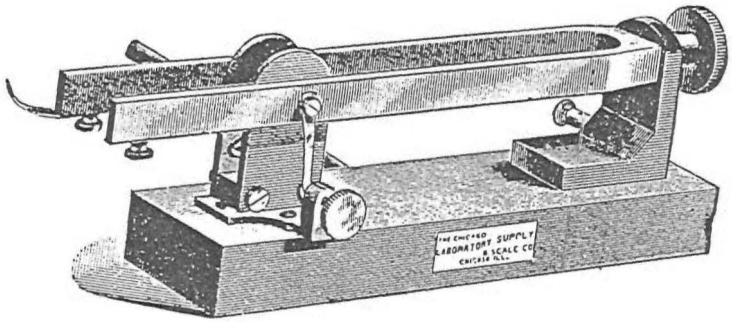


ABOVE Figure 17. The clockwork mechanism of a clockwork Kymograph, C.H. Stoelting
BELOW Figure 18. Kymograph, C.H. Stoelting (Whipple, 1924)



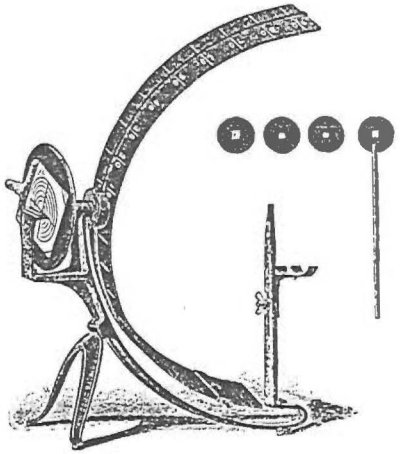


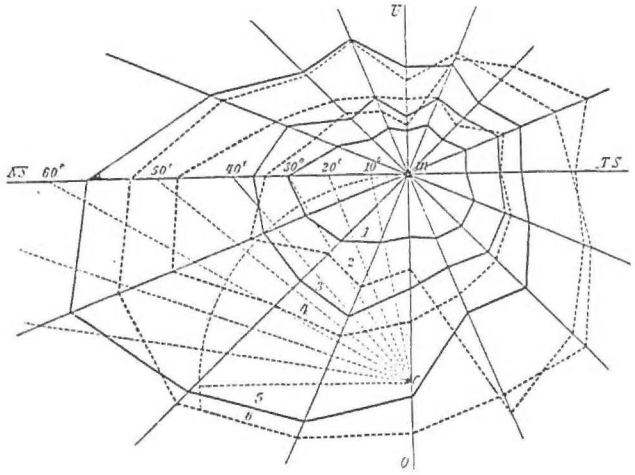
LEFT Figure 19. Kymograph, C.F. Palmer
ABOVE Figure 20. Electromagnetic tuning fork, C.F. Palmer




LEFT Figure 21. Electromagnetic tuning fork, Chicago Laboratory Supply & Scale Company (Whipple, 1924)

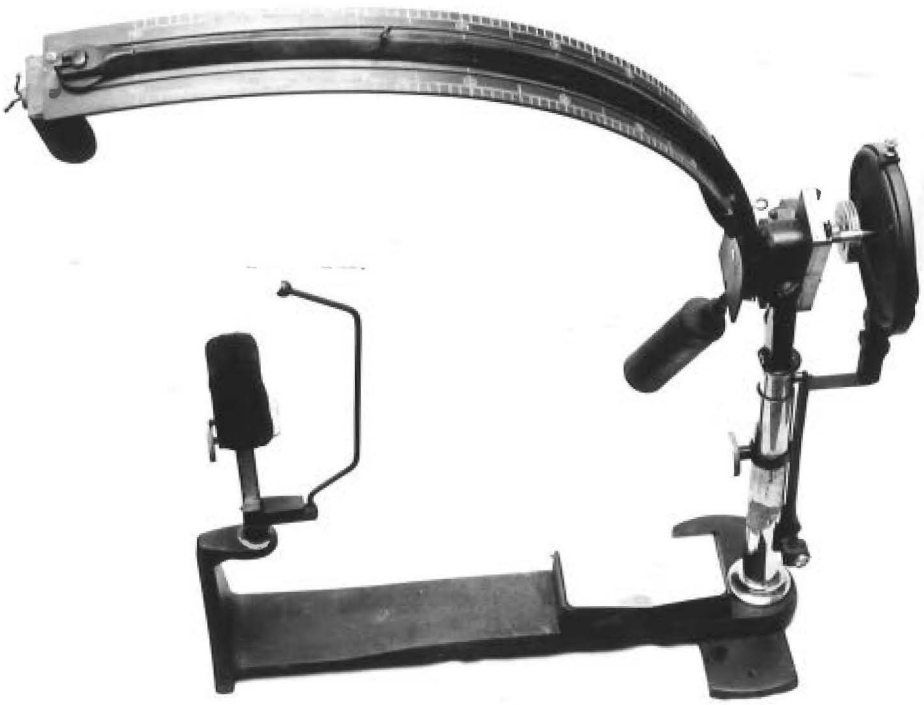
RIGHT Figure 22. Resistance Box, Gambrell Brothers Ltd



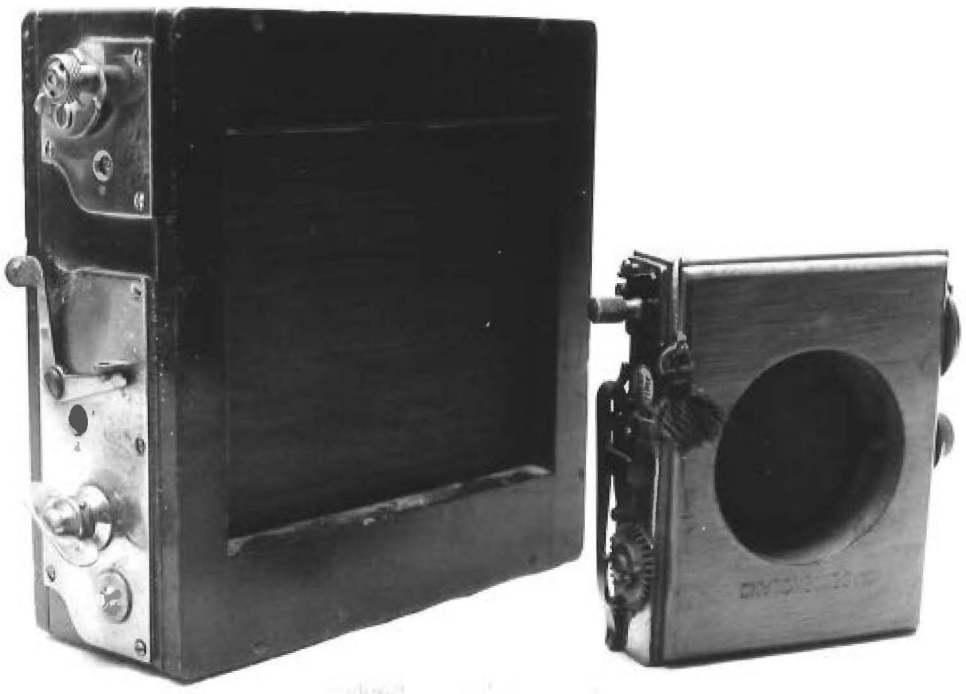


Perimeter Chart. Limits beyond which the colors disappear: 1, Violet; 2, Yellow; 3, Green; 4, Red; 5, Orange; 6, Blue.

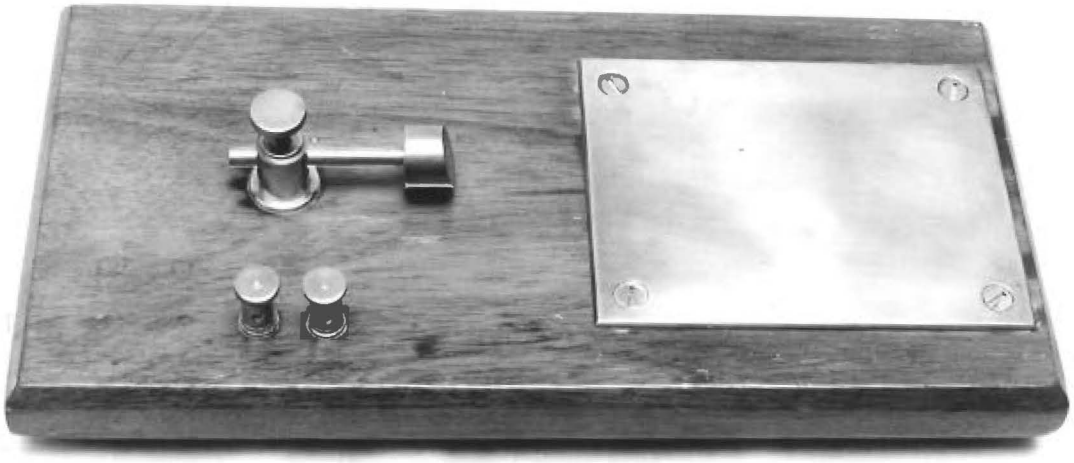
LEFT Figure 23. Colour Mixer, James Shelley
ABOVE LEFT Figure 24. Perimeter (Scripture, 1895)
ABOVE RIGHT Figure 25. Perimeter Map (Scripture, 1895)



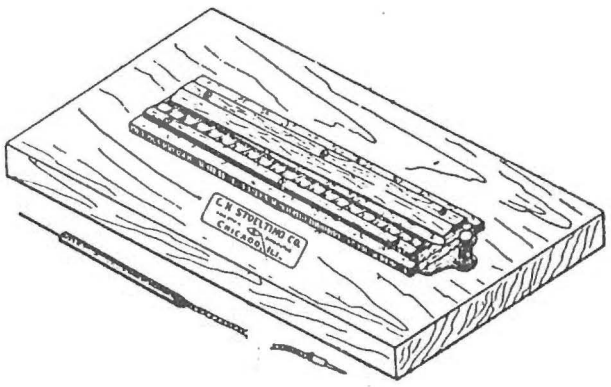
ABOVE Figure 26. Perimeter, Curry & Paxton
BELOW Figure 27. Focal Plane Shutters,
Thornton Pickard & C.H. Stoelting

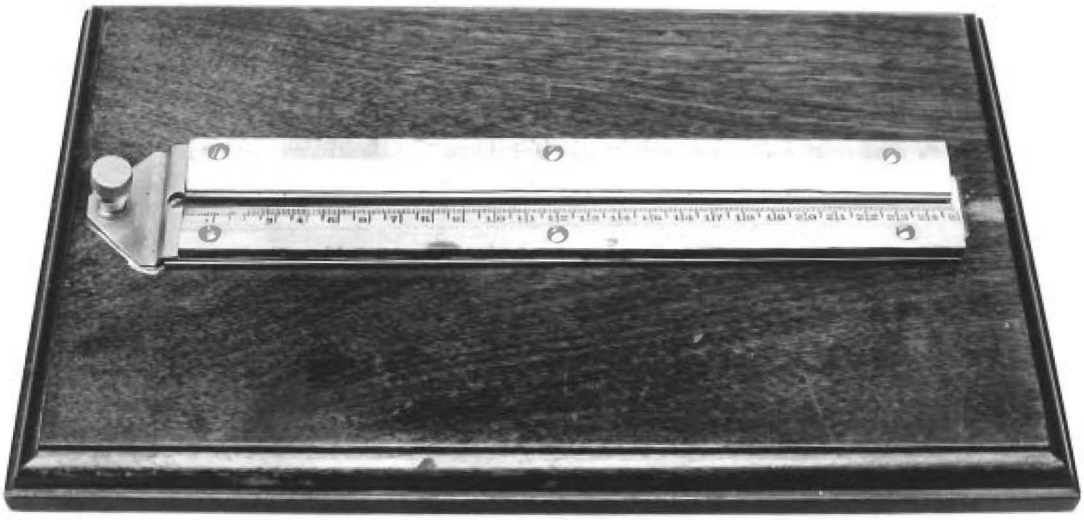



ABOVE Figure 28. Helmholtz Resonators
RIGHT Figure 29. Koenig Resonator

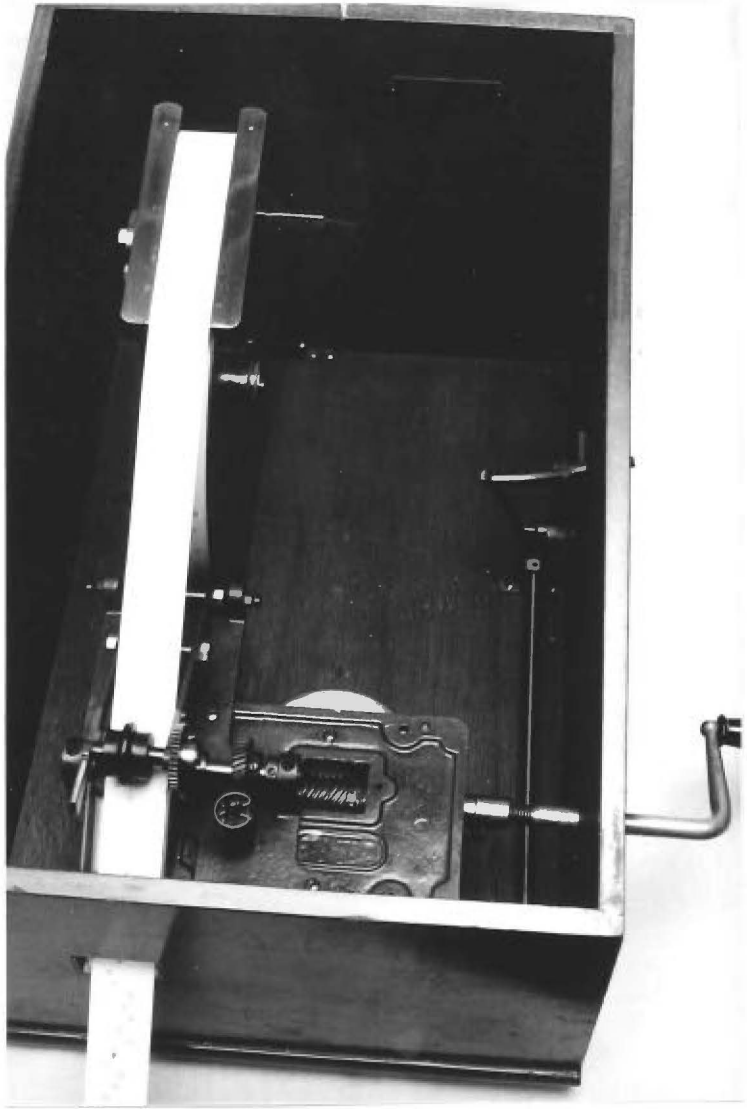


ABOVE Figure 30. Shock-plate
BELOW Figure 31. Steadiness Tester,
C.H. Stoelting (Whipple, 1924)

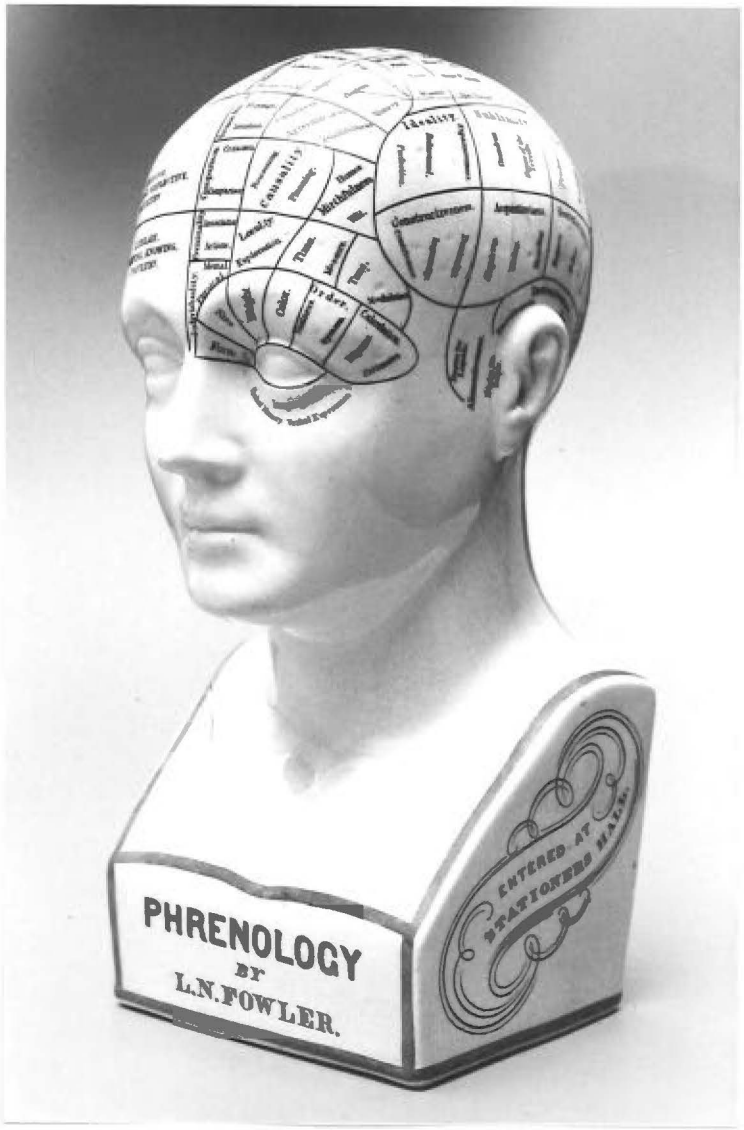




ABOVE Figure 32. Steadiness Tester, C.H. Stoelting
BELOW Figure 33. McDougall Dotter, C.F. Palmer



LEFT Figure 34.
McDougall Dotter,
interior view,
C.F. Palmer
RIGHT Figure 35.
Phrenological Bust,
L.N. Fowler



# References

Albrecht, F.M. (1960) The New Psychology in America: 1880-1895 Doctoral Dissertation, Johns Hopkins University, Baltimore, Maryland.

Anon (1888a) The magic lantern as a teaching appliance Scientific News 1(1) N.S., 9.

Anon (1892a) Letters and notes American Journal of Psychology 4930 501-502.

Anon (1897) Notes Studies from the Yale Psychological Laboratory 5, 104.

Anon (1943) Christian H. Stoelting American Journal of Psychology 56, 450.

Balance, W.D.G. (1975) Frustrations and joys of archival research Journal of the History of the Behavioral Sciences 11(1) 37-40.

Baldwin, J.M. (1892) The psychological laboratory at the University of Toronto Science 19, 143-144.

Baldwin, J.M. (ed) (1911) Dictionary of Philosophy and Psychology (vol. 1) Macmillan, New York.

Beeby, C.E. (1979) Psychology in New Zealand fifty years ago (in) R. St. George (ed) The Beginnings of Psychology in New Zealand Department of Education, Massey University, Palmerston North. Delta Research Monograph No. 2, 70-76.

Beeby, C.E. (1991) Interview of C.E. Beeby by D. Youngmeyer, unpublished manuscript.

Bentley, M. (1909) Some new apparatus. I. An observational table American Journal of Psychology 20(2) 278-279.

Bergstroem, J.A. (1903) A new type of ergograph, with a discussion of ergographic experimentation American Journal of Psychology 14(3-4) 246-276.

Berman, L.H. (1967) Oral history as source material for the history of Behavioral Sciences Journal of the History of the Behavioral Sciences 3(1) 58-59.

Boring, E.G. (1965) On the subjectivity of important historical dates: Leipzig 1879 Journal of the History of the Behavioral Sciences 1(1) 5-9.

Boring, E.G. (1967) Psychologist's letters and papers Isis 58(1) 103-107.

Bringmann, W.G. (1975) Design questions in archival research Journal of the History of the Behavioral Sciences 11(1) 23-26.

Brown, L.B. & Fuchs, A.H. (1969) The Letters between Sir Thomas Hunter and E.B. Titchener Publications in Psychology, Victoria University of Wellington, Wellington.

Brown, L.B. & Fuchs, A.H. (1971) Early Experimental Psychology in New Zealand: The Hunter-Titchener letters Journal of the History of the Behavioral Sciences 7, 10-22.

Brozek, J. (1975) Irons in the fire: Introduction to a symposium on archival research Journal of the History of the Behavioral Sciences 11(1) 15-19.

Cadwallader, T.C. (1975) Unique values of archival research Journal of the History of the Behavioral Sciences 11(1) 27-33.

Cattell, J.McK. (1888) The psychological laboratory at Leipzig Mind 13, 37-51.

Cattell, J. McK. (1898b) The psychological laboratory Psychological Review 5(6) 655-658.

Cattell, J. McK. & Dolley, C.S. (1895) On reaction-time's and the velocity of the nervous impulse Memoirs of the National Academy of Sciences 7, 393-415.

Caudle, F.M. (1983) The developing technology of apparatus in Psychology's early laboratories Annals of the New York Academy of Sciences 412, 19-55.

Cohen, E. (1991) Psychology's attic Akron Fall, 12-19.

Conklin, E.S. (1926) The new psychological laboratory at the University of Oregon American Journal of Psychology 37, 155.

Crafts, L.W., Schneirla, T.C., Robinson, E.E. & Gilbert, R.W. (1938) Recent Experiments in Psychology McGraw-Hill, New York.

Crowther, D. (1991) Interview of D. Crowther by D. Youngmeyer, unpublished manuscript.

Danziger, K. (1990) Constructing the Subject: Historical Origins of Psychological Research Cambridge University Press, Cambridge.

Daumas, M. (1972) Scientific Instruments of the Seventeenth- and Eighteenth-Centuries and their Makers (trans) M. Holbrook, B.T. Batsford, London.

Davis, A.B. & Merzbach, U.C. (1972) Graphic Recording in Psychology: The Kymograph APA, Washington.

Davis, A.B. & Merzbach, U.C. (1975) Early Auditory Studies: Activities in the Psychology Laboratories of American Universities Smithsonian Studies in History & Technology, no. 31. Smithsonian Institution Press, Washington.

Davis, R.C. (1970) The brass age of Psychology Technology & Culture 11(4) 604-612.

de Vries, L. (1973) Victorian Inventions John Murray, London.

Encyclopaedia Brittanica (1911) (11 ed) Cambridge University Press, Cambridge.

Fernberger, S.W. (1928) The first psychological laboratory at the University of Pennsylvania Psychological Bulletin 25(8) 445.

Gardner, W.J., Beardsley, E.T. & Carter, T.E. (1973) A History of the University of Canterbury, 1873-1973 University of Canterbury, Christchurch.

Garvey, C.R. (1929) List of American Psychology laboratories Psychological Bulletin 26, 652-660.

Guralnick, S.M. (1975) Science and the Ante-Bellum American College American Philosophical Society, Philadelphia.

Harper, R.S. (1949) The laboratory of William James Harvard Alumni Bulletin 51, 169-173.

Harper, R.S. (1950) The first Psychological laboratory Isis 41, 158-161.

Hatfield, H.S. (1948) The Inventor and His World Penguin, Penguin, Middlesex.

Hoeffding, H. (1891/1912) Psychology (trans) Mary E. Lowndes. Macmillan & Co., London.

Hughes, T.P. (1988) Model builders and instrument makers Science in Context 2(1) 59-75.

Hunter, T.A. (1952) The development of Psychology in New Zealand Quarterly Bulletin of the British Psychological Society 3, 101-111.

Jamieson, B. (1990) Industrial Psychology: The Canterbury Tales. A paper presented at the New Zealand Psychological Society Conference, August.

Jewkes, J., Sawers, D. & Stillerman, R. (1969) The Sources of Invention (2 ed) Macmillan, London.

Krohn, W.O. (1892b) The laboratory of the psychological institute of the University of Goettingen American Journal of Psychology 5, 282-284.

Langfeld, H.S. (1926) Princeton psychological laboratory Journal of Experimental Psychology 259-270.

MacDonald, A. (1905) Man and Abnormal Man Senate Document No. 187, 224-226.

McDougall, W. (1904-5) On a new method for the study of concurrent mental operations and of mental fatigue British Journal of Psychology 1, 435-445.

McDougall, W. (1916) An Introduction to Social Psychology (11 ed) Methuen, London.

McPherson, M.W. (1975) Some values and limitations of oral histories Journal of the History of the Behavioral Sciences 11(10 34-36.

McPherson, M.W. & Popplestone, J.A. (1984) European Psychology as represented in the Archives of the History of American Psychology (in) H. Carpintero & J.M. Peiro (eds) Psychology in its Historical Context Monografias de la Revista de Historia de la Psicologia, Valencia.

McPherson, M.W., Popplestone, J.A. & Whitmore, J. (1967) An Exhibit in Honor of the 75th Anniversary APA Division of the History of Psychology, APA, Washington.

Manning, G. (undated) Transcript of Sir James Shelley: A Radio Portrait.

Martin, L.J. (1906) The electrical supply in the new psychological laboratory of the Leland Stanford, Jr., University American Journal of Psychology 17, 274-79.

Miner, B.G. (1904) Changing attitude of American universities toward psychology Science 20, 299-307.

Myers, C.S. (1911) A Text-book of Experimental Psychology. Part II. Laboratory Exercises (2 ed) Cambridge University Press, Cambridge.

Oxford English Dictionary (2 ed) Prepared by J.A. Simpson & E.S.C. Weiner, Oxford University Press, Oxford, 1989.

Popplestone, J.A. (1975) Retrieval of primary sources Journal of the History of the Behavioral Sciences 11(1) 20-22.

Popplestone, J.A. (1980) The influence of the apparatus of the Leipzig laboratory in the U.S.: 1880-1910 (in) W. Meischner & A. Metge (eds) Wilhelm Wundt: Progressives Erbe, Wissenschaftentwicklung and Gegenwart Karl-Marx-Universitat, Leipzig, 158-163.

Popplestone, M.W. (1985) The legacy of memory in apparatus and methodology Ebbinghaus-Studien 2 Passauer Schriften zur Psychologiegeschichte, Institut fur Geschichte der Neuren Psychologie der Universitat Passau, 203-215.

Popplestone, J.A. & McPherson, M.W. (1971) The Archives of the History of American Psychology American Archivist 34, 13-19.

Popplestone, J.A. & McPherson, M.W. (1984) Pioneer Psychology laboratories in clinical settings (in) J. Brozek (ed) Explorations in the History of Psychology in the U.S. Bucknell University Press, Lewisburg, 196-272.

Popplestone, J.A. & McPherson, M.W. (undated) The vitality of the Leipzig model of 1880-1910 in the U.S. in 1950-1980.

Pringle, H.F. (1930) Profiles: Gadget-maker The New Yorker 19 April, 24-26.

Reymert, M.L. (1928) The new psychological laboratory of Wittenberg College American Journal of Psychology 40, 171.

Ruckmick, C.A. (1912) The history and status of Psychology in the United States American Journal of Psychology 23, 517-531.

Ruckmick, C.A. (1926) Development of laboratory equipment in the United States American Journal of Psychology 37, 582-591.

Rusk, R.R. (1921) Experimental Education Longman, London.

Salmond, C.F. (1923) News and notes Australasian Journal of Psychology & Philosophy 1(1) 74.

Salmond, C.F. (1925) Review of "Experience and Nature" by John Dewey Australasian Journal of Psychology & Philosophy 3(3) 230-31.

Salmond, C.F. (1927) Instinct, emotion and appetite Australasian Journal of Psychology & Philosophy 5 (1) 13-28.

Salmond, C.F. (1928) Review of "The World as an Organic Whole" by N.O. Lossky Australasian Journal of Psychology & Philosophy 6(4) 310-311.

Salmond, C.F. (1929) Some aspects of modern thought Australasian Journal of Psychology & Philosophy 7(1) 1-18.

Salmond, C.F. (1930) Psychology, literature and human nature Australasian Journal of Psychology & Philosophy 8(1) 23-42.

Samelson, F. (1974) History, origin myth and ideology: 'Discovery' of Social Psychology Journal for the Theory of Social Behaviour 4(2) 217-231.

Sandford, E.C. (1890) A simple and inexpensive chronoscope American Journal of Psychology 3(2) 174-81.

Sanford, E.C. (1893) Some practical suggestions on the equipment of a psychological laboratory American Journal of Psychology 5, 429-438.

Sanford, E.C. (1898) The vernier chronoscope American Journal of Psychology 9(2) 191-197.

Scripture, E.W. (1894) Work at the Yale laboratory Psychological Review 1, 66-69.

Scripture, E.W. (1895) Thinking, Feeling, Doing Flood & Vincent, Pennsylvannia.

Scripture, E.W. (1897) Principles of laboratory economy Studies from the Yale Psychological Laboratory 5, 93-103.

Sokal, M.M. (1972) Psychology at Victorian Cambridge - the unofficial laboratory of 1887-1888 Proceedings of the American Philosophical Society 116, 145-147.

Sokal, M.M., Davis, A.B. & Merzbach, U.C. (1975) A national inventory of historic psychological apparatus Journal of the History of the Behavioral Sciences 11(3) 284-86.

Sokal, M.M., Davis, A.B. & Merzbach, U.C. (1976) Laboratory instruments in the history of Psychology Journal of the History of the Behavioral Sciences 12(1) 59-64.

St. George, R. (1987) Psychology in New Zealand: A history and commentary (in) G.H. Blowers & A.M. Turtle (eds) Psychology Moving East: The Status of Western Psychology in Asia and Oceania Sydney University Press, Sydney, 325-344.

St. George, R. (1990) Legacies of Empire for psychology in New Zealand Journal of the History of the Behavioral Sciences 26(4) 359-365.

Stocking, G.W. (1965) On the limits of 'presentism' and 'historicism' in the historiography of the Behavioral Sciences Journal of the History of the Behavioral Sciences 1, 211-17.

Stout, G.F. (1901) A Manual of Psychology (2 ed) Hinds & Noble, London.

Stout, G.F. (1908) The Groundwork of Psychology Clive, London.

Stratton, G.M. (1896) The new psychological laboratory at Leipzig Science N.S. 4, 867-868.

Sully, J. (1906) Outlines of Psychology Longmans, Green & Co., London.

Titchener, E.B. (1898a) A psychological laboratory Mind 7, 311-331.

Titchener, E.B. (1900a) The equipment of a psychological laboratory American Journal of Psychology 11(2) 251-265.

Titchener, E.B. (1900b) The Psychological Laboratory of Cornell University Oliver B. Wood, Worcester: Massachusetts.

Titchener, E.B. (1903) Class experiments and demonstration apparatus American Journal of Psychology 14(3-4) 175-191.

Titchener, E.B. (1904) Some new apparatus American Journal of Psychology 15(1) 56-61.

Titchener, E.B. (1909) Some new apparatus. II. A demonstrational stereoscope American Journal of Psychology 20(2) 279.

Titchener, E.B. (1901/1918) Experimental Psychology: A Manual of Laboratory Practice Vol. I. Qualitative Experiments Part II. Instructor's Manual Macmillan, New York.

Titchener, E.B. & Whipple, G.M. (1909) Some new apparatus. III. Tuning-forks for tests of pitch-discrimination American Journal of Psychology 20(2) 279-281.

Turner, G. (1983) Nineteenth-Century Scientific Instruments Sotheby Publications, University of California Press.

Turtle, A.M. (1979) Anniversary year for Psychology - 1979 Australian Psychologist 14(3) 261-272.

Underwood, B.J. (1949) Experimental Psychology: An Introduction Appleton-Century, New York.

Warren, H.C. (ed) (1935) Dictionary of Psychology George Allen & Unwin, London.

Weiss, A.P. (1927) The psychological laboratory of Ohio State University Journal of Experimental Psychology 434-445.

Whipple, G.M. (1924) Manual of Mental and Physical Tests Part I. Simpler Processes (3 ed) Warwick & York, Baltimore.

Winterbourn, R. (1940) Vocational guidance in New Zealand Occupational Psychology 14(3) 162-174.

Winterbourn, R. (1953) A review of Psychology in New Zealand Australian Journal of Psychology 5, 17-27.

Wolfe, H.K. (1895) The new psychology in undergraduate work Psychological Reports 2, 382-87.

Woodworth, R.S. (1922) Psychology: A Study of Mental Life Methuen, London.